Vol. 6 JULY, 1912 No. 1

QUARTERLY

OF THE

National Fire Protection Association

Entered as second-class matter May 1, 1911, at the Post Office at Boston, Mass., under act of July 16th, 1894.

87 MILK STREET, BOSTON, MASS.

EDITED BY THE SECRETARY

National Fire Protection Association.

President—H. L. PHILLIPS.
Vice-President—G. M. ROBERTSON.
Secretary and Treasurer—FRANKLIN H. WENTWORTH,
87 Milk Street, Boston, Mass.

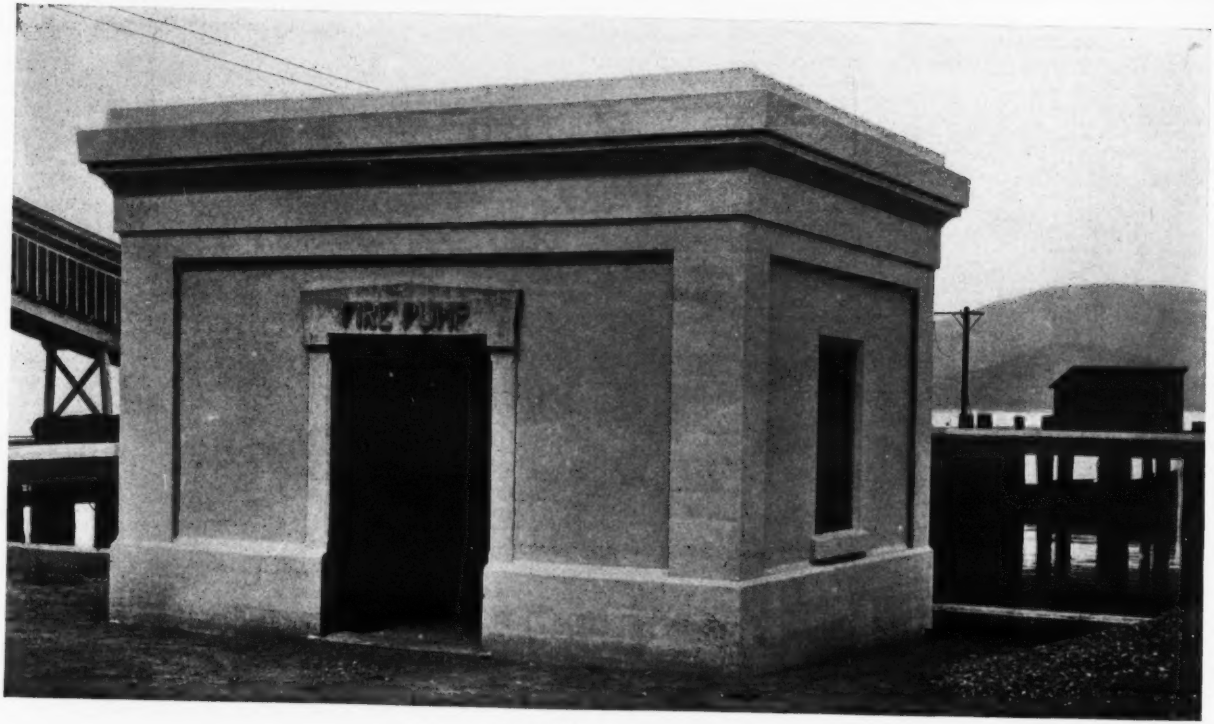
Active Members.

American Institute of Architects.
American Institute of Consulting Engineers.
American Institute of Electrical Engineers.
American Electric Railway Association.
American Warehousemen's Association.
American Water Works Association.
Associated Factory Mutual Fire Insurance Cos.' Inspection Bureau.
Association of Fire Underwriters of Baltimore City.
Board of Fire Underwriters of Allegheny County.
Board of Fire Underwriters of the Pacific.
Board of Fire Underwriters of Territory of Hawaii.
Boston Board of Fire Underwriters.
Buffalo Association of Fire Underwriters.
Bureau for Safe Transportation of Explosives.
Canadian Fire Underwriters' Association.
Canadian Manufacturers Association.
Chicago Board of Underwriters of Chicago.
Cincinnati Fire Prevention Bureau.
Cleveland Inspection Bureau.
Cotton Insurance Association.
Electrical Supply Jobbers Association.
Factory Insurance Association.
Factory Mutual Laboratories.
Fire Underwriters' Electrical Bureau.
Fire Underwriters' Inspection Bureau.
Hudson Inspection Bureau.
Illinois Inspection Bureau.
Illinois State Fire Prevention Association.
Independent Petroleum Marketers' Association of U. S., The
Indiana Inspection Bureau.
Insurance Association of Providence.
International Acetylene Association.
International Association of Fire Engineers.
Iowa State Fire Prevention Association.
Kansas Fire Insurance Inspection Office.
Kentucky Actuarial Bureau.
Kentucky State Fire Prevention Association.
Louisiana Fire Prevention Bureau.
Louisiana State Society for the Reduction of Fire Waste.
Mainland Fire Underwriters' Association of British Columbia.
Mass. Assn. of Municipal Electrical Inspectors.
Massachusetts Mutual Fire Insurance Union.
Michigan Inspection Bureau.
Michigan State Fire Prevention Association.
Milwaukee Board of Fire Underwriters.
Minnesota State Fire Prevention Association.
Mississippi Inspection and Advisory Rating Company.
Missouri Actuarial Bureau.
Missouri Fire Prevention Association.
Mutual Fire Prevention Bureau.
National Association of Cement Users.
National Association of Credit Men.
National Association of Electrical Inspectors.
National Association of Local Fire Insurance Agents, The
National Association of Manufacturers of United States.
National Assn. of Master Gravel and Slag Roofers of America
National Assn. Sheet Metal Contractors of United States.
National Board of Fire Underwriters.
National Electrical Contractors' Association.
National Electric Light Association.
National Hardware Association of U. S., The
National Paint, Oil and Varnish Association.
Nebraska Inspection Bureau.
Nebraska State Fire Prevention Association.
Newark Inspection Bureau.
New Brunswick Board of Fire Underwriters.
New England Bureau of United Inspection.
New England Insurance Exchange.
New Hampshire Board of Fire Underwriters.
New York Board of Fire Underwriters.
New York Fire Insurance Exchange.
North Carolina Fire Prevention Association.
North Dakota State Fire Prevention Association.
Nova Scotia Board of Fire Underwriters.
Ohio Inspection Bureau.
Ohio State Fire Prevention Association.
Oklahoma Inspection Bureau.
Oklahoma State Fire Prevention Association.
Philadelphia Fire Underwriters' Association.
Philadelphia Suburban Underwriters' Association.
Rocky Mountain Fire Underwriters' Association.
South Carolina State Fire Prevention Association.
South Dakota State Fire Prevention Association.
South-Eastern Underwriters' Association.
St. Louis Fire Prevention Bureau.
Suburban Fire Insurance Exchange.
Tennessee Inspection Bureau.
Texas Fire Prevention Association.
The Union.
Underwriters' Assn. of the Middle Department.
Underwriters' Association of New York State.
Underwriters' Bureau of Middle and Southern States.
Underwriters' Bureau of New England.
Underwriters' Laboratories, Inc.
Virginia Fire Prevention Association.
Western Actuarial Bureau (Fire).
Western Canada Fire Underwriters' Association.
Western Factory Insurance Association.
Western Sprinklered Risk Association.
West Virginia Inspection Bureau.
West Virginia State Fire Prevention Association.
Wisconsin Inspection Bureau.
Wisconsin State Fire Prevention Association.

Table of Contents.

A Model Pump House ..... Frontispiece
Editorial 5
Public Education 11
Comparative Statistics of Fire Loss 16
Conflagrations During 1911 21
Progress in the Adoption of the National Standard Hose Couplings and Hydrant Fittings for Public Fire Service. *F. M. Griswold* 22
How to Detect Obstructions in Mains Which Supply Fire Protection Systems. *Frederick C. Moore* 30
Fire Line Meters:—A Comparison of Efficiency. *George Houston* 33
Discharge Characteristics of Automatic Sprinklers. *Fitzhugh Taylor* 48
Sprinkler Tank Failures 50
Iron Hoops for Wooden Water Tanks 64
Jamestown Conflagration. *Chas. E. Eldridge* 65
Color, Paint and Varnish Factories. *F. E. Roberts* 67
Department of Fire Record 79
Breweries—Fire Record 81
Unsatisfactory Sprinkler Fires 93
Fire-Resistive Buildings—Fire Record 107
Miscellaneous Fires 121
Fire Causes 123
Points of Interest from Fire Reports 125
Standard Rules and Requirements 127

Reports on fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.



A Model Pump House.

He Simply Had to Steal.

Prometheus stole the fire from heaven.
"My last match went out," he explained.

The Quarterly

Vol. 6 July, 1912 No. 1

The Annual Meeting. It seems to be the general opinion among the members that the May meeting was the most interesting of any in recent years. The attendance was large and continuous, the handsome new auditorium of the Chicago Insurance Exchange being well filled at each session. The reasonable size of this room made the discussions readily intelligible and encouraged the members to speak from the floor. President Merrill's exceptional gifts as a presiding officer made it possible to get through the program on schedule time, and devote the last afternoon to the coveted visit to the Laboratories, which means so much to those who do not get to Chicago often.

The discussions this year were of especial interest, and members who devote the time to a reading of the published proceedings will be well repaid. Our active member the International Association of Fire Engineers was most happily represented by its president, Chief W. H. Loller of Youngstown, Ohio, whose virile words on the subjects in which he was especially interested awakened considerable enthusiasm. Governor Deneen's message, presented by Fire Marshal Doyle (who has since been appointed Secretary of State for Illinois), Mr. Heaton's presentation of the Canadian situation and Mr. Fox's paper on the Calibre of Fire Streams were three exceptional contributions. The testimonial gifts of appreciation to Mr. C. M. Goddard by his friends and admirers in the late Underwriters' National Electric Association, and to retiring President W. H. Merrill by the N. F. P. A., in acknowledgment of his vigorous and splendid two years of administration, added the touches of sentiment which are seldom absent from our sessions despite the prevailing atmosphere of technical deliberation.

Much good work was accomplished. The Committee on Private Fire Departments and Fire Drills completed its valuable service; the Committee on Mine Fires registered a good beginning; the Committee

on Laws and Ordinances presented a portfolio indicative of enormous and painstaking labor; and the Committee on Standards brought before the Association the initial draft of a standard for Standpipe and Hose Systems for Buildings. The various other committees made their usual routine reports either revising present standards or indicating excursions into new and interesting fields.

A prominent member of one of the leading organizations of the country was heard to say at the University Club subsequent to our meeting, "It is my lot to attend many conventions during the year but I do not know of any in which so great a volume of important work is disposed of with such never-failing good nature in the clash of opinions, and such devotion to the work in hand. You fellows do stick to your job! You don't loaf and you don't duck, and your atmosphere from the moment you assemble is one of serious business."

Other visitors in years past have made similar comments.

* * * * *

The Executive Committee. Chairman F. J. T. Stewart lost no time in getting the work of his committee under way as soon after the annual meeting as possible. President-elect H. L. Phillips at once took up with the other officers the matter of committee appointments, and the Executive Committee met June 12th to confirm the same and to transact routine business. At this meeting the subcommittee (Messrs. Stewart, Goddard and Mallalieu), to which four subjects were referred at Executive Committee meeting January 24th, reported as follows:—

(*a*) Conference with Laboratories in revision of statement on index cards that wired glass is suitable "for moderate exposures only" resulted in changing card wording to read "except where exposure is severe."

(*b*) Conflicts in reports of Committees on Fire Prevention Ordinances, Automobile Garages and Theatre Construction have been reconciled.

(*c*) It was decided to include in ordinance for motion picture houses specification for ventilation of booth.

(*d*) It was decided to specify the size of tanks for water supply in theatre sprinkler protection as incoporated in report of Committee on Theatre Construction.

The report of the committee was accepted; the Ordinances on Motion Picture Houses and Theatre Construction adopted as amended, and it was voted to recommend the same to the National Board of Fire Underwriters for publication.

The Secretary was instructed to write Mr. H. C. Henley, delegate to convention of Internationl Association of Fire Engineers, requesting his delegation to convey to the convention the appreciative thanks of the National Fire Protection Association for the action taken at the last convention indorsing the practice of purchasing public department fire hose manufactured in accordance with the specifications of the National Fire Protection Association.

The Secretary was instructed to convey the appreciative thanks of the Association to the Comité Technique Contre L'Incendie et Les

Accidents, of Paris, France, for its courtesy in making the President and Vice President of the Association honorary members of that Committee.

The appointment of a delegate to the Sixth Congress of the International Association for Testing Materials was referred to the President and Secretary. (Mr. A. G. Patton of New York was subsequently chosen.)

It was voted: That a special committee be appointed to revise the Association's pamphlet on Field Practice and present the same for adoption to the next annual meeting; and to recommend to the committee that such pamphlet should be adapted for general use among municipal and other inspectors.

Matter of appointment of representative on Advisory Committee of the "New York Fire Exposition and International Congress of Fire Protection and Extinguishment" was laid upon the table.

It was voted: That the Signaling Committee be asked to revise the pamphlet "Protection against Lightning," to determine whether modifications of the same should be made to encourage the installation of lightning rods having favorable service record but not now acceptable under the specifications.

It was voted: To appoint a Canadian Committee to assist in extending the influence of the Association in Canada.

The following matters referred to the committee by the annual meeting were considered:—

(*a*) It was voted: To appoint a special committee to consider the question of further classification of associate memberships as regards transferring some of the federal, state and municipal organizations into the active class.

(*b*) The matter of the connection of sprinkler systems to high pressure fire service systems was referred to the following committees for joint consideration and report to the Executive Committee:—

(1) Committee on Private Fire Supplies from Public Mains.
(2) Committee on High Pressure Fire Service Systems.
(3) Committee on Automatic Sprinklers.

(*c*) It was voted: That all model laws and ordinances submitted to the last meeting of the Association by the Committee on Laws and Ordinances be adopted and that their publication be recommended to our active member the National Board of Fire Underwriters. This action covered the following measures:—

(1) A state fire marshal law.

(2) A state law and a city ordinance governing the manufacture and handling of matches.

(3) A state law to regulate the transportation and carriage of explosives.

(4) A state law to regulate the manufacture, storage, sale and use of explosives.

(5) Two city ordinances regulating the manufacture, keeping, storage, sale, use and transportation of explosives, one for large cities and one for small cities and towns.

(6) An ordinance for inspections by fire departments, and a form to be used by city fire departments in reporting individual inspections.

(*d*) Suggestion of Mr. Powell Evans regarding fire marshal law was referred to Committee on Laws and Ordinances.

(*e*) It was voted: To ask the Committee on Automatic Sprinklers to advise the Executive Committee in the matter of Mr. Powell Evans' motion regarding modification of the Association's standards on automatic sprinkler systems.

(*f*) The resolutions introduced by Mr. Powell Evans regarding special committee on legislation and publicity and adoption of occupancy licenses by state and municipal bodies were referred to the officers for consideration and report to the committee.

(*g*) It was voted: To appoint a Committee on Automobile Fire Apparatus.

The following new committees were also constituted:—

Committee on Field Practice.
Canadian Committee.
Committee on Uniform Test Specifications for Determining Flash Point of Oils.
Committee on Blower Systems for Heating, Ventilating and Stock Conveying.
Committee on Safes and Vaults.

These committees, and those already existing which were continued, will appear in the year book.

The date of the next annual meeting was set for May 13, 14, 15, 1913, in New York City.

* * * * *

London's Fire Waste. Interesting contrasts of statistics of the fire waste appear in an article in this issue. An estimate of the monetary losses caused by fires in London from 1898 to 1911 has been submitted by the chief officer of the London fire brigade to the London county council. The estimate does not cover the expenses incurred by insurance companies and others arising out of claims for damage resulting from fires, nor does it include any consequential losses which the owners of property may have sustained.

In 1910, for fires in which the loss did not exceed $243 in any case, the total damage done was $73,605; the loss for fires between $243 and $486 was $43,336; between $486 and $2,433, $212,178; between $2,433 and $4,866, $133,438; between $4,866 and $24,332, $623,398; over $24,332, $1,844,160; in all, $2,930,115.

The annual losses from 1898 to 1909, inclusive, are given as follows:—

Years.	Loss.	Years.	Loss.
1898	$2,771,203	1904	$1,919,469
1899	2,259,165	1905	2,185,987
1900	2,507,945	1906	2,535,718
1901	3,196,579	1907	2,401,077
1902	3,951,792	1908	2,174,614
1903	1,950,853	1909	3,403,280

It will thus be seen that the total estimated loss for the 13 years amounts to $34,187,797, or an average annual fire loss of $2,629,830.

Considering the size of London, the fire losses appear to be very small, and this is accounted for by the fact that there are practically no frame buildings in London, that the warehouses and business premises generally are of slow-combustion construction, and that the dwelling houses are usually built of stone or brick, with a minimum amount of inflammable wood material. The humidity of the climate also tends very materially to keep down fire losses.

* * * * *

Conditions in Italy. The Italian city of Palermo has 360,000 inhabitants. The houses do not exceed four stories in height, the larger percentage having only two stories. They are all built of stone, including staircases and floors in all the flats. On account of the mild climate, the temperature seldom dropping as low as 40° F. during a few weeks in January, heating is almost unknown; and with the exception of the hotels, the opera house, and a few private residences, provided with steam heating appliances, not one building has a chimney. Cooking is usually done on gas or petroleum ranges, or in the old-fashioned Sicilian way by means of charcoal placed in small, square holes on the hearth and fanned into a blaze.

Fires destroying a whole block are entirely unknown, and it seldom occurs that an entire house burns to the ground. Fires are usually confined to the room or floor in which they originate. During the three years from 1908 to 1910 there were 338 fires in Palermo and 28 in neighboring communities, entailing a total loss of $90,000. Of these, only 48 were of a comparatively serious character, 78 of medium importance, and 212 insignificant.

* * * * *

Typical American Carelessness. The partial destruction a year ago of New York State's twenty million dollar Capitol caused the creation of a new office to be known as "Commissioner of Records," whose jurisdiction should cover the entire state. This office recently rendered to the State Commissioner of Education its first annual report. From this report some startling conditions are revealed anent the safety from fire of valuable records. Invaluable documents, both historical and modern, in the custody of county clerks, city clerks, surrogates and other officials in most of the fifty-nine counties outside the metropolis, are declared to be in constant danger of destruction. Flimsy safes, wooden buildings and alleged "fireproof" structures contain records upon which the titles of lands worth hundreds of millions of dollars are based, aside from thousands upon thousands of old papers, which, though of little practical use, contain data for a minute history of the state. In fact, in many of the counties the records are stacked up on wooden shelves to become the victim of the first misplaced match. That they have not been destroyed before is not because they have had any semblance of pro-

tection from the fire standpoint. Comparatively few of the county buildings are equipped with vaults or safes; or, to be more explicit, only twenty-eight out of the fifty-nine counties taken into consideration have fireproof safes or vaults in the courthouses, and most of these are so small that they hold only a part of the records. These records include data concerning the very foundation or incorporation of the towns and cities of the state.

* * * * *

The "Dry Powder Illusion." Mr. W. H. Merrill's ironic reference to the dry powder fire extinguisher as being "a good thing if all fires could be trained to occur in cuspidors" was given point in Boston recently when a well-known business man in Congress Street attempted to extinguish with two of these interesting devices a small gasolene fire around the carbureter of his 60 h. p. Berliot automobile where there was ample opportunity for a smothering gas to collect. After emptying the contents of the tubes upon the fire without effect the gentleman went into his garden and pulled some ferns with which he extinguished the fire. Mr. F. E. Cabot makes the suggestion that as the fern is more decorative than the red tube, and more effective, it might be generally substituted where people do not desire a real fire extinguisher.

* * * * *

Office Building Fire. For the interesting report and illustrations regarding the fire in the office building occupied by the Emerson-Brantingham Co., which appears in this issue in the section devoted to fires in buildings of fire-resisting construction, we are indebted to the Boston Manufacturers' Mutual Fire Insurance Co.

The name of this company invariably recalls to the pioneers in fire protection engineering the name of Edward Atkinson, who was long connected with this company and who was one of the first men in the United States to give serious thought to the scientific prevention and extinguishment of fires.

* * * * *

A Model Pump House. In the numerous details attendant upon the design and construction of a modern manufacturing plant, there is liability that the fire protection systems, and especially the location and arrangement of the fire pump, will be considered of secondary importance and left to adjust themselves to the conditions as they develop.

In many plants, in case of fire, the pump is the main reliance for good protection, and as such it is obvious that it should be so safeguarded that it can be operated as long as needed.

We show in the frontispiece of this issue of the QUARTERLY a pump house which meets the conditions demanded of such in an ideal way. It is well detached from other buildings and of fire-resistive construction.

It is arranged with due regard to future extensions of the plant and the effective handling of hose streams. The steam main from the boiler house is buried underground. This pump house combines the desirable feature of beauty with that of utility. It is an adornment to the premises and of ample dimensions to allow suitable clearance on all sides between the pump and the walls.

Public Education.

A number of members have delivered addresses upon the fire waste since the last issue of the QUARTERLY, although the approach of warm weather curtails the number of meetings at which serious subjects are considered.

Mr. H. W. Forster, of Philadelphia, made a special journey to Fairmont, W. Va., on invitation of the Chamber of Commerce, to speak before a meeting of that body, at which the mayor, councilmen, fire department, and leading business men were present. Previous to his appearance on the platform he was given an opportunity to inspect the city, and he was thus able to give direct local counsel.

* * * * *

The Cleveland, Ohio, Chamber of Commerce devoted one of its noon luncheons to consideration of the topic of the fire waste, which was made especially useful by the co-operation of the Cleveland Fire Insurance Exchange, of which Mr. A. W. Neale is president. There was an exceptionally large attendance of the leading citizens of Cleveland. Secretary Franklin H. Wentworth was the speaker.

* * * * *

The city of Milwaukee made a new departure by celebrating her "Arbor Day" on May 3d as "Fire Prevention Day" also. A mass meeting was held in the evening in the Auditorium. The speakers were the newly elected mayor, Mr. G. A. Bading, and Secretary Wentworth of the N. F. P. A. The splendid success of the meeting was due principally to the efforts of the Wisconsin State Fire Prevention Association, with which a special committee of the Milwaukee Board of Fire Underwriters, with Mr. Henry Eckstein as chairman, co-operated. The president of the Milwaukee Board, Mr. Elliott Durand, presided.

* * * * *

Secretary Wentworth went from our annual meeting at Chicago directly to New York, where he filled three important speaking engagements the following week. On May 20th he was the speaker at the

monthly meeting of the Manufacturers Association of New York City; on May 22d he spoke at the annual convention of the National Association of Manufacturers at the Waldorf-Astoria, and on May 23d at the annual meeting of the National Board of Fire Underwriters. At the last-mentioned meeting Mr. Charles E. Meek shared the speaking with Mr. Wentworth.

* * * * *

Mr. O. M. Thurber, Secretary-Treasurer of our active member the North Dakota State Fire Prevention Association, who has been especially active as a writer and speaker in the Dakotas and Minnesota, and who has been editing the little journal at Fargo, *The Fire Prevention and Insurance Review*, has been called to the editorial desk of *Fire Protection*, the publication recently started by the *Western Underwriter*.

* * * * *

Mr. Louis Wiederhold, Jr., a member of our Executive Committee, delivered an interesting address before the Fire Insurance Society of Philadelphia, in which he reviewed the birth, progress and influence of the N. F. P. A., and described its work in the compilation of codes and standards for fire prevention.

* * * * *

The City Club of Chicago, which has previously manifested its interest in fire prevention, through its Committee on Fire Protection and Building Regulations, of which Mr. Frank D. Chase is chairman, has recently brought to the attention of the superintendent of the Chicago schools the question of instruction regarding the fire waste, and has prepared a list of books on the subject for supplemental reading by the school children. The committee has also prepared a bill for introduction into the legislature requiring periodical instruction in fire prevention in the schools of the state.

* * * * *

The campaign of our active member the Massachusetts Mutual Fire Insurance Union to secure the local adoption by towns and cities of the state of an act of the legislature regulating fires in the open air has resulted already in the adoption of the same by thirty-nine towns.

* * * * *

The borough of Glen Ridge, N. J., has formed a fire prevention bureau to advise and suggest precautions and preventives that will reduce the number of fires, and prevent loss of life and property. Its secretary, Mr. R. R. Williams, Jr., declares that, with the exception of a house struck by lightning, every fire in Glen Ridge last year was due to carelessness, and therefore preventable.

Upon application, this bureau will send one of its members to consult with a citizen at his convenience, with a view of giving such advice or making such suggestions as will render his home less liable to fire.

Practical appliances for fire protection, suitable for use in residences, are exhibited in the borough council rooms, which are open to visitors during the office hours of the borough clerk and on one evening of each week. A Fourth of July ordinance has just been passed through the influence of this bureau. Glen Ridge is not a metropolis, but it is ahead of some in metropolitan methods.

* * * * *

One of our members in Little Rock, Ark., Mr. W. Ross McCain, was the speaker at the convention of the Local Agents Association of Arkansas, and ably brought before that body the responsibility of its members to the cause of fire prevention. Among other good things he said:—

"To-day America has the finest and most perfect fire-fighting systems in the world, especially in the large cities. To-day every new device which promises improvement and adds speed in arriving at the scene of a fire is received with welcome.

"Yet with all the new inventions, with systems which are the wonder of all foreign nations, with men whose deeds entitle them to be called heroes, the fires in this country are continually increasing in number and in the amount of property destroyed.

"President McKinley called the attention of Congress to the fact that the fire loss of the United States and Canada had reached the enormous figure of $150,000,000 annually. In twelve years time this had increased to $250,000,000 annually, and we are informed for the first quarter of the year 1912 the fire losses have been running at the rate of $1,000,000 per day. How, with our so nearly perfect systems can this be? Because the United States has been working at the wrong end,—she has been trying to destroy an effect without doing away with the cause. While we have been perfecting inventions to put out fires after they have started, continental Europe has been working on the other tack,—they have been perfecting systems to keep them from starting.

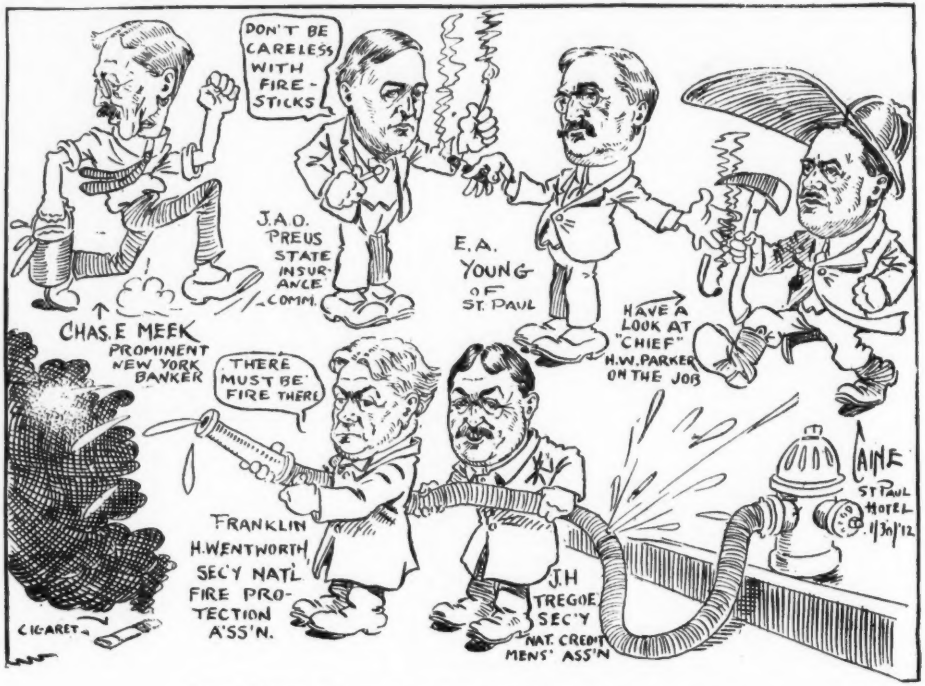
"Some years ago yellow fever was one of the worst scourges of the Southern States. Every energy was directed towards stamping out the fever after it had started. Finally the stegomyia was discovered to be the cause, sanitation was introduced, precautions were taken to kill out this particular species of mosquito, and to-day yellow fever is no longer a bug-bear. So it can be with fires. If the people will arouse themselves and devote their attention to removing the cause of fires, the now terrible waste will cease to be a menace."

* * * * *

Mr. Ira G. Hoagland delivered a very thoughtful and well-prepared paper before the convention of the International Association of Factory Inspectors at Washington, D. C., on the subject of factory fire prevention. Beginning with a criticism of present factory laws and suggestions for their improvement, he reviewed the various hazards present in industrial establishments and offered practical suggestions for their control or abolition, concluding with an outline of systems of fire detection and extinguishment, and recommendations for proper exit facilities for employees.

* * * * *

Our member the Bureau of Combustibles and Fire Risks of Newark, N. J., has issued the "Fire Prevention Code" of Newark, being a com-


DON'T BE CARELESS WITH FIRE-STICKS
J.A.O. PREUS STATE INSURANCE COMM.
E.A. YOUNG OF ST. PAUL
HAVE A LOOK AT "CHIEF" H.W. PARKER ON THE JOB
CHAS. E MEEK PROMINENT NEW YORK BANKER
THERE MUST BE FIRE THERE
FRANKLIN H. WENTWORTH SEC'Y NAT'L FIRE PROTECTION A'SS'N.
J.H. TREGOE SEC'Y NAT. CREDIT MENS' ASS'N
CIGARET
LAINE ST PAUL HOTEL 1/30/'12

Doing Things to Stop The Fire Waste—*Saint Paul Pioneer Press.*

pilation of the city ordinances relating to this important subject. The publication is in the form of a handy little book of a size to carry in one's pocket. Captain Gasser is a leader in devising popular methods of educating his people. In most cities it is almost impossible to get a copy of any ordinance in convenient form.

* * * * *

Our active member the Hudson Inspection Bureau, and its devoted corps of engineers, has been endeavoring to awaken the people of Jersey City to the significance of the fire waste. In this campaign it has had the assistance of one ot the local papers, *The Journal*, which has been especially helpful in advocating a sane celebration of Independence Day; going after the city officials for their alleged indifference to this important matter. On May 29th a mass meeting was arranged at one of the public schools, and Secretary Wentworth secured as a speaker.

* * * * *

Secretary Wentworth appeared as a speaker at the annual banquet of the Insurance Institutes of America held June 11th in Boston at the Exchange Club. He was the only speaker on his especial subject, the other three speakers being ex-Insurance Commissioner Hotchkiss of New York, and the present insurance commissioners, Hardison of Massachusetts and Merrill of New Hampshire.

* * * * *

The National Association of Credit Men once more demonstrated its interest in the problem of the fire waste at its annual convention at Boston in June, when Mr. Henry W. Eaton and President Geo. W. Babb of the National Board of Fire Underwriters appeared as speakers. As usual the report of the Insurance Committee of the Credit Men referred principally to fire prevention. After the presentation of the report and before the introduction of Mr. Eaton members from all parts of the country arose in their places in the convention and testified to the exceptional services rendered by Mr. Charles E. Meek and Secretary Franklin H. Wentworth of the N. F. P. A. At the conclusion of the discussion an enthusiastic vote of thanks was tendered by the convention to the above named gentlemen.

Mr. Meek was subsequently honored by election to the first vice presidency of the Credit Men by acclamation. Mr. Meek, who went to the Fourth National Bank, New York, a year ago as assistant cashier, has been recently elected vice president of that important financial institution. To his activities and influence in bringing to the support of our cause the co-operation of the most important commercial organization in America, our Association owes an exceptional debt. Mr. Meek's interest does not flag. As a member of our Executive Committee he is fruitful in constant helpful suggestions and declares that he stands ready to cooperate with our Secretary in any further speaking tours the latter has the courage to undertake.

Comparative Statistics of Fire Loss.

American and Foreign.

The Committee on Statistics, of the National Board of Fire Underwriters, recently submitted their annual report on the fire losses for the year 1911. An analysis of their report and comparison with a similar analysis which we made of their report for 1910 show very clearly that this country is still suffering a tremendous annual fire loss; and the fact that certain cities may make a favorable showing one year is no criterion that they may safely pass through another year with an equally favorable record. The per capita loss for the cities of 20,000 population and over in the United States was $2.62. This was twenty-three cents greater than in 1910. A comparison of the figures for the United States shows that more than one-third of the total loss of the entire country is borne by one-third of the population of the country. It also appears, from a study of the relation of fire losses in urban and rural population centres, that losses on property under what may be classed as the better fire protection have abnormally increased, while losses on property having poorer or no protection have materially lessened.

In a group of the twenty-eight cities of the country having a population of 200,000 or over, St. Paul stood the highest with a per capita loss of $3.87; Kansas City came next with a per capita loss of $3.74; and Cincinnati was third with a per capita loss of $3.67. In 1910 the latter had second place with a per capita loss of $5.24. The average per capita loss for this group of twenty-eight cities was $2.42, which was ten cents above the average for 1910, and the per capita loss in fifteen of these cities was greater than the average. The city in this group having the smallest per capita loss was Baltimore, which was ninety-three cents. Providence came next with $1.01, and Cleveland had a per capita loss of $1.07. In 1910 Cleveland stood next to the lowest with a loss per capita of $1.19. The ten cities having a population over 200,000, and less than 300,000, had a per capita loss of $2.64.

In a group of eighteen cities having a population of 300,000 or over, the average per capita loss was $2.39, which was three cents over that of 1910. In this group eleven cities have a greater per capita loss than the average for the group. In this group Cincinnati had the largest per capita loss; St. Louis came next with a per capita loss of $3.31; and Boston was third with a per capita loss of $3.26. Baltimore holds minimum place

here, with Cleveland next and New Orleans third from the lowest, with a per capita loss of $1.18. The seven cities having a population over 300,000, and less than 400,000, had a per capita loss of $3.07.

In a group of eleven cities having a population of 400,000 or over, St. Louis had the largest per capita loss; Boston came next; and Chicago was third with a loss of $2.59 per capita. Baltimore again made the best showing in this group, and Cleveland came next. Philadelphia was third from the lowest with a per capita loss of $1.37. The average per capita loss for this group is $2.27, which is thirteen cents higher than 1910. Five of these cities had a per capita loss greater than the average for the group.

The smallest per capita loss reported in any city with a population of 20,000 or over, was in Central Falls, R. I., a city of 24,000, which had a per capita loss of eleven cents. Zanesville, Ohio, a city of 29,000, came next with a loss of fifteen cents; and Steubenville, Ohio, with a population of 23,000, had a per capita loss of eighteen cents. The cities which enjoyed the lowest per capita loss in 1910 had a loss of thirty-four cents, $2.28 and 81 cents respectively this year.

The following table shows the thirty-four cities which had a per capita loss over $5.00, as compared with the cities which had a loss of over $5.00 in 1910. The large loss in Bangor, Maine, and Houston, Texas, is attributable to conflagrations.

1911.

Bangor, Me.	$187.43	Minneapolis, Minn.	$6.74
Houston, Tex.	44.50	Muskogee, Okla.	6.67
Winona, Minn.	21.08	Ottumwa, Ia.	6.55
Little Rock, Ark.	17.24	Amsterdam, N. Y.	6.49
Dubuque, Ia.	15.01	Superior, Wis.	6.47
Sheboygan, Wis.	11.30	Wichita, Kan.	6.47
Paducah, Ky.	11.15	Battle Creek, Mich.	6.35
Port Huron, Mich.	10.73	S. Bethlehem, Pa.	6.25
Ogden, Utah	10.36	Racine, Wis.	6.06
S. Omaha, Neb.	10.13	Gloversville, N. Y.	6.05
Council Bluffs, Ia.	8.88	San Jose, Cal.	6.01
Gloucester, Mass.	8.46	Salem, Mass.	5.63
Leavenworth, Kan.	8.14	Duluth, Minn.	5.52
Troy, N. Y.	8.07	Reading, Pa.	5.48
Malden, Mass.	7.53	Birmingham, Ala	5.24
Kalamazoo, Mich.	7.52	Brookline, Mass.	5.14
Dallas, Tex.	7.07	Atchison, Kan.	5.09

1910.

Vicksburg, Miss.	$18.60	*Bangor, Me.	$6.21
Petersburg, Va.	14.85	*Atchison, Kan.	6.11
Jamestown, N. Y.	12.38	Tacoma, Wash.	5.93
Portsmouth, Ohio	10.81	Norfolk, Va.	5.92
Kansas City, Kan.	8.89	Rockford, Ill.	5.87
Stockton, Cal.	8.88	El Paso, Texas	5.76
Fresno, Cal.	8.23	Omaha, Neb.	5.73
Everett, Wash.	7.74	*Sheboygan, Wis.	5.58
*Dallas, Texas	7.39	Danbury, Conn	5.46

Spokane, Wash.	7.37	Paterson, N. J.	5.46
Wilmington, N. C.	6.62	Lynchburg, Va.	5.37
*Amsterdam, N. Y.	6.61	Cincinnati, Ohio	5.24
*Minneapolis, Minn.	6.60	Boston, Mass.	5.15
Lima, Ohio	6.57	Evansville, Ind.	5.14
East Liverpool, Ohio	6.56	Meridian, Miss.	5.11
Memphis, Tenn.	6.46	Waco, Texas	5.02
Burlington, Vt	6.22		

*These cities in this class in both years.

The average per capita losses in those states having several cities with a population of 20,000, or over, were as follows:—

	1910.	1911.
Massachusetts, 29 cities	$2.77	$2.47
Connecticut, 10 cities	2.08	2.20
*New York, 26 cities	1.95	2.40
New Jersey, 16 cities	2.42	1.74
*Pennsylvania, 26 cities	1.54	1.63
Virginia, 8 cities	3.41	1.25
Texas, 9 cities	4.10	10.06
Ohio, 21 cities	2.48	1.63
Indiana, 12 cities	1.49	1.49
*Illinois, 18 cities	2.68	2.48
*Michigan, 11 cities	3.66	2.70
Wisconsin, 10 cities	2.28	3.40
Iowa, 10 cities	2.10	4.29
*California, 11 cities	2.78	2.06

*One city less in 1910.

A comparative classification of cities with a population of 20,000 or over, according to the amount of the per capita loss into the following fifteen groups, is of interest.

Per Capita Loss.	1910. No. of Cities.	1911. No. of Cities.
Less than 25 cents	5	3
25 to 49 cents	18	20
50 to 74 cents	22	33
75 to 99 cents	32	30
$1.00 to 1.49	56	53
1.50 to 1.99	36	34
2.00 to 2.49	34	27
2.50 to 2.99	23	20
3.00 to 3.49	8	24
3.50 to 3.99	13	13
4.00 to 4.99	18	10
5.00 to 5.99	14	6
6.00 to 7.99	12	14
8.00 to 9.99	3	4
10.00 and more	4	10

Relation of Number of Fire Alarms to Population.

There were ten cities in which there were more than one fire alarm for every one hundred of population. The city having the greatest number of fire alarms as compared to population was Concord, N. H., a city of 22,000,

in which there was an alarm of fire for every seventy of population. Newton, Mass., with a population of 41,000, came next with an alarm for every eighty-one people, and Meridian, Mississippi, a city of 25,000, followed closely with one alarm for every eighty-seven of population. In 1910 Meridian had the greatest number of alarms, one for every eighty-two, and Newton followed with one for every ninety-four of population. All the other cities which reported had less than one fire for every one hundred of population.

The city having the least number of fires was South Bethlehem, Pa., which has a population of 20,000 and a record of one fire for each 1,667 of population. Norristown, Pa., a city of 29,000, held this position last year and came next this year, with one fire for each 1,205 people. New Brunswick, N. J., a city having a population of 24,000, reported one alarm for every 1,149 of population. Vicksburg, Mississippi, and Shenandoah, Pa., each reported one alarm for every thousand people. All the remaining cities that reported had a record of more than one fire for every one thousand of population. As in 1910, only sixteen cities besides these just mentioned had a record of less than one fire for every five hundred of population. All the remainder had a record of one fire for less than every five hundred and more than one hundred of population.

A comparison of the number of fire alarms and per capita losses in cities which had both high and low per capita losses, or large and small number of fire alarms, during the past two years, appears to show that there is no comparative relation between the number of fires and per capita loss which a city may have.

A Study of Fires in Foreign Cities.

England. Eleven out of twelve of the largest cities had a per capita loss of less than one dollar. Sheffield, a city of 478,763 people, had the minimum per capita loss of fifteen cents, and Bolton, a city of 180,885, had a loss of eighteen cents per capita. Birkenhead, with a population of 131,000, had the maximum loss in this group of ninety-two cents, and occupied a similar position in 1910 with a per capita loss of ninety-nine cents. York, a city of 82,297, had a per capita loss of $2.73. The average per capita loss of these cities was fifty-three cents. Only three of these cities had a fire for less than each 1,000 of population, and the average was one fire for every 1,515 people. In London the fire loss was $3,945,015, or a per capita loss of fifty-four cents. There was one alarm for each 1,492 of population. The average loss per fire was $896. The average loss per fire for all cities was $805.

Ireland. Belfast, with a population of 385,000, had a per capita loss of ninety-three cents, and Dublin, with a population of 309,272, had a loss of thirteen cents. The average per capita loss of these cities was fifty-eight cents. The average number of fire alarms was one alarm for every 1,961 of population. The average loss per fire was $1,144.

Scotland. Aberdeen, with a population of 163,877, had a per capita

loss of thirty-seven cents, and Edinburgh, with a population of 320,313, had a loss of sixty-six cents. The average per capita loss of these cities was fifty-six cents. The average number of fire alarms was one alarm for every 1,786 of population.

The average loss per fire was $436.

France. Marseilles, a city of 550,500 people had a per capita loss of $1.27. Paris, with a population of 2,846,986, had a loss of sixty cents; and Roubaix, with 121,017 people, had a per capita loss of $3.64. The average per capita loss of these cities was eighty-one cents. The average number of fire alarms was one for every 700 of population. In Paris there was one alarm for every 658 of population. The average loss per fire among these cities was $570. In Paris the average loss per fire was $396.

Germany. Among eight of the largest cities,—but not including Berlin, Dresden, Frankfurt on the Main, and Flensburg,—Stuttgart, with a population of 293,345, had the minimum per capita loss of eight cents. The highest per capita loss occurred in Frankfurt, a city of 68,800, and the loss was fifty-seven cents. The average per capita loss of these cities was twenty-one cents. The greatest number of fire alarms occurred in Bremen, a city of 247,437, where an alarm occurred for every 440 of population. The least number occurred in Kaiserslauten, a city of 54,662, where there was one alarm for each 1,754 of population. The average for all the cities reporting was one alarm for every 676 of population.

Berlin had a fire for each 709 of population. The fire loss was not reported.

Italy. Among the six largest cities, Milan, with a population of 619,256, had the maximum per capita loss of forty-six cents, and Ravenna, a city of 70,000, had the minimum per capita loss of seven cents. The average per capita loss of the cities reporting was thirty-one cents. The average loss per fire was $291. Brescia had a fire alarm for each 395 of population and Ravenna had an alarm for every 3,448 people. The average for all cities was one fire for each 935 of population.

Russia. Moscow, a city of 1,575,583, had a per capita loss of $1.46; St. Petersburg, with a population of 1,907,708, had a loss of ninety-three cents. The average per capita loss of these cities was $1.17. The average loss per fire was $1,852. In Moscow there was one fire alarm for each 1,428 of population and in St. Petersburg there was one fire for every 1,772 of population. The average was one fire for every 1,587 of population.

In Vienna, Austria, a city of 2,031,498, the per capita loss was eight cents. The average loss per fire was $84. There was one fire alarm for every 1,010 of population.

In Vancouver, Canada, a city of 125,000, the per capita loss was $2.61. The average loss per fire was $1,755, and there was one fire alarm for every 671 of population.

General. The average per capita loss for these foreign countries, as enumerated, was sixty cents. The average fire loss was $654. The average number of fire alarms was one for every 1,099 of population.

Conflagrations Involving Losses of $500,000 and Over Occurring in 1911.

(From Records of the *Journal of Commerce.*)

January	3	Little Rock, Ark.	Hollenbert Musical Co. Bldg. and others	$1,000,000
	5	Minneapolis, Minn.	Minn. General Elec. Co. plant	720,000
February	5	Jefferson City, Mo.	State House	1,000,000
	7	Point Richmond, Cal.	Standard Oil Co., Sulphuric Acid plant and others	500,000
	17	Chicago, Ill.	Calumet Grain Elevator	500,000
	22	Donaldsonville, La.	Business section	750,000
	23	White Plains, N. Y.	Admiral Dot Hotel, Wm. Armbuster Harlem Hotel, Braendes Bldg., and others	500,000
	28	Kokomo, Ind.	Haynes Automobile Co. plant	750,000
March	5	Minneapolis, Minn.	Syndicate Block	1,178,000
	19	Chicago, Ill.	Storage Whse. (Monarch Refrigerating Plant)	1,100,000
	20	Benton, Pa.	(Bloomsburg) Rohr McHenry Distilling Company	1,000,000
	24	Fayette, Ala.	County Court House, Fayette Co. Bank, Turner Hotel and stores	500,000
	24	Eros, La.	Lumber plant	500,000
	29	Albany, N. Y.	State Capitol Bldg.	5,500,000
April	3	Richmond, Wis.	(Apple River Falls) St. Croix Elec. Power Co. plant, near Somerset	500,000
	18	Jacksonville, Fla.	Doeher Gardner Co. Lumber Plant and cars	500,000
	30	Bangor, Me	Conflagration	3,500,000
May	27	Coney Island, N. Y.	Amusement Parks	2,225,000
	28	Dubuque, Ia.	Standard Lumber Co. Yards	500,000
June	15	St. Louis, Mo.	Huttig Sash and Door Co. Works and others	700,000
	23	W. Hammond, Ill.	Cattle Feed Factory (Chapin & Co.)	500,000
	26	Medford, Okla.	Business section	500,000
July	9	Chicago, Ill.	Arthur W. Dixon Transfer Co., stables and stock yards	500,000
	14	Waters, Mich.	Henry Stephens & Co., Lumber Plant and Timber land	1,125,000
	19	Brooklyn, N. Y.	Cowperthwait Co. and others	560,000
August	23	Clayton, N. Y.	Frontenac Hotel	500,000
	28	Elmhurst, Wis.	Sawmill and general	700,000
November	16	Ogden, Utah	Eccles Bldg.	750,000
December	22	Shenandoah, Pa.	West Shenandoah Coal Colliery,	700,000
	22	Brooklyn, N. Y.	Print and Bk. Plant and others, F. E. & M. Vernon & Hartford Brass Bed Co.	500,000
	31	Washington, Ohio	Court House (several Business Houses, etc.)	$1,250,000
				$31,008,000

NOTE.—Some of these losses are higher than the total losses reported by the Chief of Fire Department for the year.

Progress in the Adoption of the National Standard Hose Couplings and Hydrant Fittings for Public Fire Service.

By F. M. Griswold (Member N. F. P. A.).

Extract from an address before the American Waterworks Association June, 1912, showing the historical approach to this important work in which Mr. Griswold has for many years represented the National Fire Protection Association with untiring and unselfish devotion.

It is remarkable in this age of advancement that so important and universally necessary a public utility as that of fire-hose couplings should have been permitted for so many years to escape the influence of the spirit of progress, and remain a matter subject to the caprice or ignorance of those responsible for the installation of such important adjuncts to public fire protection.

In the following remarks in relation to the National Standard hose couplings, I crave your indulgence in offering to you a brief outline of past endeavors to secure the standardization of this very important public utility. It appears to be established as a fact that the first concerted attempt to secure the adoption of a standard hose coupling dates from the organization meeting of the National Convention of Fire Engineers, held in the city of Baltimore, Md., October, 1873, when, with the lesson of the great Chicago fire of 1871, added to that of the conflagration in Boston, November, 1872, before them, this assemblage of fire chiefs from all sections of the country, gave expression to their desire to have a standard hose coupling which would serve for general use, in a resolution offered by Chief Hill, of the Cleveland, Ohio, department, to the following effect:—

"Whereas experience has shown that the fire departments of the country should be provided with a universal or standard coupling for hose and fire hydrants, so that when a city or town calls for aid, in case of large fires or conflagrations, from another city or town, each department can act in unison with the other. Therefore, be it resolved that a committee be appointed by this convention to take under consideration, and report back to this convention the practicability of adopting a standard coupling of some kind to be used by all fire departments throughout the United States."

In forwarding this resolution its proposer expressed the desire to have adopted a standard of such character "that a line of hose might be

laid from coast to coast, with couplings which would permit any town on the line to tap in." While the printed record of this convention does not give exact details of the dimensions of the standard then adopted, contemporary documents appear to establish it as being of 2½ inches inside diameter, 3 1-16 inches outside diameter over thread of male end, with 7½ threads to the inch. Accepting this standard as being official, some of the chiefs who were in attendance at that convention, upon returning to their home towns, changed their couplings to conform and have since maintained that standard in operation.

Outside of the instances noted, the matter of standardization appears to have failed of immediate accomplishment, owing to the fact that no concerted and continued action was undertaken by that body to keep the proposition alive, seemingly being content to let the resolutions appear in the printed proceedings of the convention as closing the incident.

Notwithstanding the unsatisfactory results from this first effort, the necessity for securing harmony in the dimensions of this most important adjunct to fire-fighting facilities was sufficiently strong to again bring the matter before the firemen's organization at their convention in 1875, when there was adopted as its standard a coupling showing 2⅝ inches inside diameter, by 3⅛ inches outside diameter, "exclusive of the thread," and of 3⅜ inches outside diameter inclusive of the thread, the latter to be 8 to the inch. In the 1876 convention this standard was reaffirmed, but as in the case of the first effort (1873), printing the resolutions in the convention proceedings appears to have again marked the limit of active effort by this organization until its convention of 1878, when a special committee reported that the 1875 specifications were found to be "impracticable in use," and here again the matter rested, no new specifications being presented to the convention.

In 1879 the firemen again took up the subject and this time submitted as their standard a coupling showing 2½ inches inside and 3 7-32 inches outside diameter, with six V-shaped threads to the inch, which was duly adopted, but the matter lay dormant until the convention of 1883, when the 1879 specification was endorsed, and resolutions passed to secure co-operation through state legislation. While some sporadic effort seems to have been made toward this end, nothing was accomplished which held promise of success, and the matter appears to have been dropped entirely.

During the seven years between 1883 and 1890 there is no record of action being taken on the matter of standardization, but in the latter year the firemen's convention appointed a committee to investigate prevailing conditions throughout the country in relation to hose couplings in order to report a standard for adoption in 1891, and to this end Mr. C. A. Landy, a fire hose salesman, was appointed chairman of the committee, and at the convention held at Springfield, Mass., in 1891, presented a very complete and comprehensive report, covering the details of coupling dimensions in use in some 1,339 towns and cities of the country, where 2½-inch fire hose was in service, showing outside dimensions over male ends ranging from 3 to 3⅛ inches, and including 7, 7½ and 8 threads to

the inch, and, having demonstrated by the use of a model coupling of 3 1-16 inches outside diameter, with 7½ threads to the inch, that about 70% of the couplings listed in his report might serviceably be converted to use with a coupling of these dimensions, through the simple process of decreasing the diameter of the male thread, or of increasing that of the female swivel, urged the adoption of a standard conforming to these dimensions as an intermediary which would permit standardization at the least expense of time or money.

The demonstrated feasibility of adapting these non-conforming couplings to practically serve with the proposed standard carried conviction to the members of the convention, and a standard for 2½-inch hose was adopted under specifications showing 3 1-16-inch outside diameter over male end, with 7½ threads to the inch, but in nominating the number of threads for the larger sizes of couplings, the committee then having the matter in charge increased them in ratio proportional to the expansion in diameters, thus presenting a mechanical anomaly not to be tolerated in practice; and, doubtless, "with a sense of duty well performed," a resolution to print these specifications in the proceedings served to again "close the incident."

For thirteen years after the adoption of a standard in 1891 (which action was simply an endorsement of the specifications of 1873), the hose coupling proposition appears to have reposed in undisturbed quietude.

Confronted with this record of thirty-one years of failure to secure the adoption and use of a practical standard hose coupling, it became evident that if success was to be the reward of further effort in this work, it could only be won by co-operation between the leading organizations or other interests controlling the production of, or being responsible for the purchase, installation and up-keep of these highly important public fire-fighting facilities. With a hope of being able to arouse general interest in this method of procedure, the National Fire Protection Association selected your relator as its delegate to the convention of the International Association of Fire Engineers which was held at Chattanooga, in September, 1904, instructing him to propose joint action by these two organizations in a renewal of the effort to devise an acceptable and practical "National Standard Hose Coupling."

This proffer of co-operation being accepted, each of these Associations designated a special committee to give the matter consideration; The International Association of Fire Engineers selecting J. R. Canterbury, then chief of the fire department of Minneapolis, Minn., as chairman of its committee, while it fell to the lot of your relator to be honored with a like position in behalf of the National Fire Protection Association.

Being thus commissioned, the committee of the National Fire Protection Association began its allotted task with a full knowledge of the too frequently demonstrated fact that the average public fire department is not so fully equipped as to enable it to successfully cope with a fire of conflagration proportions without having to call for and secure assistance from outside sources; and that in such cases, almost without an exception,

experience had proven that when willing response had been made and the foreign apparatus had arrived upon the ground, it was discovered that those who came to help were unable to do so effectively, simply because, in some minor, but vital particular, the apparatus of the helper would not interchange with that in use by those who so earnestly sought and needed help.

Investigation of these untoward conditions developed the fact that the difficulties experienced in such cases arose mainly from the existence of a fractional part of an inch of difference in the dimensions of the hose couplings or hydrant outlets, or because differences in the shape or number of threads on same were sufficient to prevent the proper interchange of such utilities.

It became a question whether to advise the adoption of a hose coupling, the specifications of which would show the extreme of mechanical strength without reference to the preponderance of designs of a less theoretical value then in general use; or to seek for the introduction of a coupling the characteristics of which would most closely accord with the majority class, and at the same time prove to be an intermediary of such capacity as to accommodate itself to interchange with a large proportion of couplings not exactly conforming to its dimensions.

Accepting the latter method of procedure as promising the widest measure of success, the committee of the National Fire Protection Association undertook a special investigation of existing conditions, using the Landy report of 1891 as a basis, and after securing much additional data in that line, became convinced of the practical value of the specifications named in that excellent report, and suggested as a standard coupling for 2½-inch hose one showing a diameter of 3 1-16 inches over male end thread, with 7½ threads to the inch, by the use of which it was practically demonstrated that couplings ranging in outside diameter from 3 1-32 inches to 3 5-64 inches, with either 7, 7½ or 8 threads to the inch, could be so modified as to serviceably couple up with this suggested standard, and thus render over 70% of the majority couplings known to be in use conformable to the proposed "standard" at small expense as to time, money or labor.

In elucidation of the essential features of this proposed "standard" it was deemed wise to formulate specifications covering 2½, 3, 3½ and 4½-inch hose couplings, the inside diameters of which were to be in conformity with the sizes named. The details in relation to the 2½-inch size may be briefly stated to be of 60 degree V-shaped pattern with an outside diameter over male end of 3 1-16 inches, and a pitch of 7½ threads to the inch; the more specific details relating to all of the standard sizes being shown in the printed pamphlet obtainable of the National Fire Protection Association.

Having come to this decision, the committee, bearing in mind the failure of past effort because of the lack of co-operation between interests vitally concerned, sought the co-operation of organizations having supervision over the installation of these public utilities, and to that end

took the matter up with the Insurance Committee of the American Waterworks Association at a conference held at New York in April, 1905, at which there was also present a number of the Associate members of your Association specially invited to give consideration to the subject from the manufacturers' viewpoint.

At this conference the details of specifications as above presented were very critically considered and accepted without change, as being of such practical utility as to warrant general adoption, and on the recommendation of this joint committee the "National Standard Hose Coupling" was adopted by your Association at its convention held at West Baden, Ind., in May, 1905, at which time Chief Canterbury, chairman of the Hose Coupling Committee of the International Association of Fire Engineers, was present by invitation, and as your records will show gave his verbal approval to the adoption of the specifications as submitted.

Appreciating this action of your influential Association, the committee of which I have the honor to be chairman was inspired to renewed effort in "spreading the gospel of standardization," and pushed its endeavor to secure further official acceptance and approval of the standard specifications, and to that end presented the proposition to the International Association of Fire Engineers at its convention, held at Duluth, August, 1905, when, and notwithstanding the fact that Chief Canterbury, chairman of the Hose Coupling Committee of that Association, presented a report advocating the adoption of a coupling having six threads to the inch, the convention voted almost unanimously in approval of the "National Standard" specifications, thus supporting the action taken by your Association.

Following this action at Duluth, the committee secured other approvals of the standard, either by direct appeal as a body, or through the efforts of those taking an interest in the subject, from the following important organizations and associations:—

National Board of Fire Underwriters.
New England Waterworks Association.
Pennsylvania Waterworks Association.
National Firemen's Association.
North Carolina State Firemen's Association.
Virginia State Firemen's Association.
Minnesota State Firemen's Association.
American Public Works Association.
League of American Municipalities.
American Society of Municipal Improvements.
National Fire Protection Association.

Having thus briefly outlined the record of the past history of futile endeavor in this worthy cause, extending from 1873 to 1904, let me tell you what progress has been achieved in forwarding the adoption of the National Standard Hose Coupling during the eight years which have

elapsed since the endorsement of this Standard by your Association in 1905.

When this proposition was first presented for your consideration the committee which I represent held data relating to couplings dimensions in only about 1,600 separate localities in this country; since that time it has created a card index record covering data in some 3,133 towns and cities in the United States and the Dominion of Canada. This work has been accomplished at considerable cost in money as well as in the expenditure of time and patience.

This record is believed to be as nearly accurate as can be expected in a work of this character and magnitude; the data which it contains having been very carefully compiled from ten separate sources of information, including signed statements from fire chiefs and waterwork managers, transcripts from the official records of many manufacturers of hydrants, hose or other fire department apparatus, supplemented by reports made by the engineers employed by various inspection organizations.

Analysis of the data shown in this record, based upon actual results accomplished in the conversion of non-standard couplings to safely interchange with the established standard, demonstrated that approximately 80% of the couplings listed are either of Standard dimensions or may readily be so modified as to conform to same, without necessity for replacement, while the cost of conversion or replacement has been demonstrated to be so small as to be almost negligible in the accomplishment of this very essential change from chaos to uniformity in public fire-fighting utilities.

In further evidence of progress in this work, the record shows 73 cities or towns in which the National Standard has been put into service as a result of this "Appeal to reason"; seven of these installations including the complete substitution of National Standard hose couplings and hydrant nipples in place of previously prevailing non-standard devices.

Notable among these is the city of St. Louis, Mo., the pioneer in the active promotion of standardization, in which city over eleven thousand (11,000) hydrant outlets and the couplings on many thousands of feet of fire hose were changed from a so-called "bastard" 6 thread to the Standard; all of the work being done by city employees, at an average net cost of one dollar per hose coupling, and of $2.82 per hydrant outlet, the latter being principally of 4½-inch steamer suction type, each of which was laboriously chipped-out by use of a cold chisel.

Closely following this action by St. Louis, the city of East St. Louis, which lies on the opposite shore of the river, in Illinois, brought its equipment into conformity with that of the larger city upon which it must call for aid in time of threatening disaster.

During the winter of 1910-11 the city of Springfield, Mass., discarded the "Universal clutch" coupling and substituted for it the National Standard, changing over 1,350 hydrants, some of which had four outlets,

at the rate of from 50 to 100 outlet replacements per day, at an average net cost of one dollar per outlet, giving credit for the old metal, sold at 9½ cents per pound, and excluding cost of labor performed by the regular force of waterworks employees. Couplings on 22,000 feet of hose were changed by department employees at a like net cost of one dollar each.

It is interesting to note that this work at Springfield was carried out in the winter season, and that it was accomplished without accident by the use of surprisingly simple and expeditious methods, in that where hydrant nipples were leaded in, the use of a six pound sledge proved an efficient means for their removal, while in the case of screwed-in nipples, an expanding wrench, entered from the outboard end of the nipples engaged the operating lugs and permitted the easy removal of the device, while the 4½-inch leaded-in suction nipples were melted out by the use of a plumber's gasolene blow torch, at the rate of five minutes per operation. This practical and unique demonstration of "how to do it" is commended to your serious consideration.

Following this action at Springfield, the contiguous cities of Chicopee, Holyoke and West Springfield, each brought its equipment into conformity with the Standard, at an expense probably no greater than was that of the change in Springfield

In the cases of the 66 towns and cities which are known to have adapted non-standard couplings to interchange with the Standard, the work has been accomplished entirely by the regular force of public employees, and outside of the time used, the expense has been nominal, at most involving the cost of an adjustable tap and die, conforming to the pitch of the non-standard thread, by the use of which these couplings were so modified as to become readily interchangeable with the Standard.

It will perhaps prove of interest to you to have cited some of the prominent cities and towns which have thus brought their equipment into harmony with the National Standard. Atlanta, Ga., used both 7 and 7½ thread couplings for years without serious trouble from these differences, but now uses the Standard only. Watertown, N. Y., in making the change to Standard discovered that they had three different kinds of hydrant outlets, varying both in number of threads and in their outside dimensions, all of which have been made to conform to the Standard without other cost "than the castings of a die," as stated by the chief of the fire department.

In addition to the above, the change to Standard by modification of couplings in the following cities has been accomplished at so low a cost and with so little trouble, that those responsible for this evidence of progressive action have not considered it necessary to prominently exploit their good work:—

Eufaula and Huntsville, Ala.; Enfield, New Britain and Norwich, Conn.; Moline, East Moline and Rock Island, Ill.; Elkhart and Hammond, Ind.; Davenport, Iowa; Brockton and Newburyport, Mass.; Battle Creek, Grand Rapids, Jackson, Lansing and Monroe, Mich.; Greenville

and Jackson, Miss.; Carthage and Neosha, Mo.; New Brunswick and Trenton, N. J.; Binghamton, N. Y.; Columbus, Mansfield and Wilmington, Ohio; Columbia, S. C.; Jackson and Nashville, Tenn.; Brownsville, Port Arthur and Tyler, Texas; Bellows Falls, Vt.; Everett, Port Townsend, Seattle and Tacoma, Wash.; Cudahy, Manitowoc, and Milwaukee, Wis.

This list could be materially enlarged by naming some thirty other towns of less prominence which are known to have brought their equipment into conformity with the Standard, while from information not yet verified, it is believed that a number of other localities have taken like action. In addition to the above noted instances of adaptation, the record shows the installation of the Standard in 122 localities not so listed at the date of the last issue of the Record in 1911, and as in evidence of the widespread interest aroused in this important matter of standardization, it may be stated that one prominent concern manufacturing fire hydrants, reports having filled orders for hydrants under "National Standard" specifications for some 46 separate towns and cities, included in which number may be named Montreal, Port Hope, St. Anne and St. Joseph in the Dominion of Canada, and the town of Abonito, in Porto Rico.

These facts show how cheaply and easily complete standardization may be secured. No competent mechanic can offer a valid objection to the Standard as specified, and it is not presented to your attention as a new or novel revelation in mechanic art; it is not patented, nor is it patentable.

Manufacturers of hydrant and other fire department apparatus, will hail the day when any order for such adjuncts can be safely executed by compliance with specifications demanding conformity to the "National Standard."

How to Detect Obstructions in Mains which Supply Fire Protection Systems.

Frederick C. Moore (Member N. F. P. A.)

Every little while there is a failure of some well-arranged fire system to give the efficient protection which might reasonably have been expected of it, because the water supply proves to have some obstruction in it which makes it impossible to supply the amount of water needed at a good working pressure. It is hoped that the method here described will be practiced by property owners at regular and frequent intervals, as well as by inspectors at their necessarily less frequent opportunities. The use of it by the property owner will give it the highest practical value, but we trust it will be adopted by all organizations that make inspections, as it has been already by those to which it has been presented.

The method is to draw water from the fire system under test under the same conditions each time and to set down side by side the pressure before the water is drawn and the pressure during the flow, with the date, and also to set down in like manner successively under the first record all subsequent observations, so that they may be compared and any gradual or sudden departure from the ordinary conditions be thus detected and the remedy applied. At the very top of the column should be set down the pressures obtained at some time in warm weather when freezing could not exert any influence and other conditions were known to be satisfactory, as a standard for reference. The test depends upon the fact that flow in pipes causes friction which results in a decrease of pressure.

The principle can be applied to any pipe system, but it is particularly to sprinkler systems that this test is most easily adapted and it is there of the greatest value because it can ordinarily be used on them winter or summer, and it is of the greatest importance that their water supplies be continuously maintained without fail.

Every sprinkler riser is provided with a drain pipe, usually 1½ or 2 inches, and every modern system with a gauge near that point. When a gauge is lacking it can easily be applied.

To test, first open the drain valve and let the water run a little while in order to relieve any excess pressure in the system, then close it and take the gauge reading after the gauge pressure becomes steady. Next,

open the drain valve as far as it will go and watch the gauge pressure until it ceases to fall any further and remains steady. Then, and not till then, record the flowing pressure. Finally close the drain valve and put everything in order.

Make every subsequent test under exactly the same conditions and if the initial pressure is the same as the standard test, the decrease under flow should be the same, otherwise something is wrong and investigation is necessary.

Test every riser, not merely one or two. An example of a record is given below, arranged to show some of the lessons it could teach. It is assumed that the gauges are correct.

JOHN SMITH & CO. 40 BLANK STREET,

BLANKVILLE, N. Y.

Date	*Main*	*Mill*	*Warehouse*		*Picker*	*House*	*Remarks*
	Static	Flow	Static	Flow	Static	Flow	
	85	70	85	75	90	78	Standard Pressure
1-1-12	85	71	84	73	88	77	
1-15-12	85	18	85	75	89	77	Main mill supply partly frozen. Thawed.
1-29-12	84	20	85	23	90	25	Gate from street closed for repairs last week. Only opened one turn.
2-12-12*	85	70	84	71	89	76	
7-15-12*	84	69	84	65	88	75	
11-18-12*	84	70	85	61	89	76	
4-10-13*	84	71	84	57	90	77	
8-12-13*	85	70	84	50	89	76	
12-4-13*	84	68	85	46	90	77	Warehouse supply filling with sediment.
5-6-14*	60	40	60	39	65	46	Leak in yard main.

* Assume readings were made regularly, but to save space only occasional ones are entered here.

With such a systematic and comparative record it would be difficult for any important interruption to the water supply to remain long undetected. The value of it will be evident from a study of the tabulated records above.

Generally speaking, the property owner has not been making any tests. Inspectors in the employ of bureaus have made drip tests, but they have not made them on every riser at every inspection nor have the readings been tabulated and compared, so far as the writer has knowledge from long experience with different organizations.

Where there is more than one water supply to a fire system the test will only give indications of the average conditions, but this is ordinarily of great value. To determine the condition of each supply, each one must be tested with the others shut off, but this must be done with great care because of the danger of leaving a valve closed, and for this reason the property owner is advised not to undertake it.

In calling attention to this method of testing it is necessary to urge

caution in its use, to open the drip slowly so as to be sure the full force of the stream at high pressures will not damage anything and that when it is connected into a sewer drain this has capacity enough to carry the water off without overflowing through some sink or other inlet to wet the building or valuable contents. Sprinkler drains are often arranged to discharge outdoors where the heavy flow would cause inconvenience or harm if some special arrangements were not first made. It must be plainly understood that this test is quite different from discharging the water simply to drain the system, with the supply valves shut.

The test should not be made when it is likely to draw water out of pressure tanks, and it will be necessary to immediately refill a gravity tank when the test draws water from it.

The general use of this method by property owners and inspection bureaus will materially increase the safety of properties having private fire protection, particularly those equipped with automatic sprinklers.

The practical value of this test work is being well demonstrated already by one of the bureaus which undertook this work, and it is making valuable discoveries, some of which are referred to here as illustrations.

1803.—Two-inch drip on four-inch supply lowers pressure from 115 lbs. to 45 lbs.

Two-inch drip on four-inch supply lowers pressure from 45 lbs. to 17 lbs.

513.—Two-inch drip on four-inch supply lowers pressure from 110 lbs. to 50 lbs.

Two-inch drip on four-inch supply lowers pressure from 40 lbs to 5 lbs.

811.—The pressure in a four-inch supply main was reduced from 110 lbs. to 2 lbs. due to corrosion of old mains. Supply practically useless.

3947.—Two-inch drip on six-inch supply quickly dropped the pressure from 48 lbs. down to 17 lbs. On keeping drip open for ten minutes it drew the pressure down to zero. On closing the drip the pressure slowly rose to 48 lbs. again. The six-inch pipe to the factory had been connected from a twenty-inch street main by the use of a tapping machine, which drills a hole in the large main without requiring the water to be shut off. The cutting tool has a central drill about an inch in diameter which engages the pipe first and steadies the tool before the full size drill begins to cut. It was found that the work of tapping had never been completed and that practically only a one-inch hole had been made in the large main, so that the six-inch factory fire supply to sprinklers had been fed only through a one-inch opening. This condition existed from the time the sprinklers were installed nearly a year before and made the system useless for any important fire, as this was the only supply it possessed.

Besides the condition of the water supplies, the tests are developing defects in auxiliary apparatus. We are encouraged to believe that the general adoption of this method will materially aid in the prevention of the constantly recurring large, and even total, losses in properties equipped wih automatic sprinklers.

Fire Line Meters: A Comparison of Efficiency.

(*Being a paper by* GEORGE HOUSTON *presented at the 31st annual meeting of the American Waterworks Association and the discussion thereon by members of the American Waterworks Association and the National Fire Protection Association.*)

The purpose of this paper is not to set forth any conclusions of the writer as to the relative merits or efficiency of the different kinds of what are known or frequently alluded to as fire line meters, but for the purpose of bringing out a general discussion of the question at this time, so that any municipality or water company contemplating the placing of meters on fire lines may be benefited thereby.

As most of the members of the Association are probably aware, there seem to be but two makes of meters that the underwriters will consent to have placed on what are known as sprinkler lines, without in some way making the insured party feel that his rate of insurance will be greatly increased, or the payment of insurance, in case of a fire, refused entirely, although they may have accepted his premiums as regularly as they came due and were tendered; and as one of these meters, with its registering device, requires so much room, and expense to properly install, it is unnecessary to consider it for this class of service, so we have but one meter left.

This condition, above referred to, with reference to insurance, which seems to prevail in most of our cities, would appear to be entirely unjustified unless the insurance companies can show conclusively that this meter is the only one on the market that does not in any way impair the efficiency of a sprinkler service, or that it impairs it the least of any.

The reason they give for objecting to other types of fire line meters is that they are "trash catchers" and are liable to become obstructed to such an extent that the flow of water through them will be entirely stopped, thereby entirely destroying the efficiency of the system on which they might be placed; on the other hand they claim that this one meter has no "trash catcher" in its mechanism, and that in case of a fire where more sprinkler heads break off than can be supplied through the by-pass meter, the swing valve opens in the main line, and provides for an unrestricted flow of water (and also trash) equal to the full capacity of the pipe on which it is located, and so insures an ample supply of water to all parts of the system.

Now, agreeing for the present that their contention as to the flow of

water (and trash) through this meter is well founded, and that both would pass through it unrestricted, in case of a fire, let us, with our minds perfectly unbiased and open to conviction, after we have briefly considered the general method or plan of a sprinkler system, go back to the trash that this meter of all meters permitted to pass through its open way unrestricted, after a fire had broken out, and see if plenty of water is getting to the fire.

A sprinkler system, to be brief, consists of a main pipe or riser, going up through the building, from which, at the ceiling of each story of the building, arms or branches lead off along the ceiling, and from these arms other branches or arms of much smaller pipe lead off, at right angles to the main arm, every few feet, so that, in most cases the last extension is not more than one-half or three-quarters of an inch in diameter.

In most of the factories of our city (and we have some very extensive ones) the main arms leading off from the risers range from 2 to 3 inches in diameter, and through these arms must come all the water for the sprinklers, in case of a fire.

Now, going back to the "trash" which we left for a time, after we find that it has passed through the meter all right we follow its course, and as it travels very rapidly we soon see it reach the sprinkler arm, through which the water is rushing to the fire; and what is the result? Oh! nothing, only the complete plugging up of the pipe, entirely shutting off the flow of water through the arm, thereby enabling the fire to gain such headway that it could not be extinguished, and a total destruction of the plant.

The underwriters, and the manufacturers of this particular meter, will probably say that the foregoing is merely idle imagination, and suggestive of something that in all probability never would occur. To this anticipated reply we answer: it is not idle imagination, but, on the contrary, is just what is said to have happened in the case of a large factory building in our city; with the exception that the whole building did not burn, as part of it was saved by the fire department, and a further exception that there was no meter on the line; which last exception, according to the insurance people's contention, would make conditions as nearly perfect as they could ask for; nevertheless the loss, as the writer has been informed, was over $90,000.

Now, for the purpose of comparison, let us again consider this same plant equipped as before, except that it has an 8-inch current meter on in place of the one first considered, and see what effect the "trash" that went through the first meter and plugged the sprinkler arm, shutting off the flow of water, thereby giving the fire full sway, resulting in the destruction of the building, would have had on the fire.

To do this it is only necessary to consider the area of the propellers in any of the discredited current meters, which is about 50 square inches, and compare this with the area of the trash that plugged up the sprinkler arm in the former case, which, in a desire to be fair, we will say was a 3-inch pipe, having an area of a trifle over 7 square inches.

Deducting the area of the trash that passed through the favored meter and caused the loss of the building from the area of the propeller in the other class of meters (which would be fair, as it is granted that these meters would catch the trash and hold it), we would still have left, unobstructed, 43 square inches of the propeller area in these discredited meters, less the area of the shaft and other parts of the propeller, for which we will deduct another 7 square inches, still leaving 36 square inches of open way for water to pass through, unobstructed, to feed the 3-inch sprinkler arm that was entirely closed in the other case by reason of not having a "trash catcher" on the line, in the form of a meter, and granting further that the trash might stop the propeller of these meters, thereby reducing the flow of water about 1 per cent, we will ask you to decide for yourselves whether a sufficient quantity of water would or would not pass through to supply the sprinkler arm in question.

If it would, can we not rightfully conclude that the discredited meters are better for sprinkler systems than the one approved by the underwriters, for the very reason that the insurance companies condemn them, namely—they *are* "trash catchers," and would hold in check trash that would pass right through the approved meter and choke up the system, while at the same time they provide for a flow of water through them, sufficient to extinguish almost any incipient fire, after they have held up far more trash than it would take to plug up almost any arm on the sprinkler riser.

One of the representatives of an underwriters' association informed certain members of our city council that in case any "trash catcher" meter was put on the sprinkler line to any of their risks and a fire should occur in the building so equipped, and it was found that the water had been stopped by trash, his company would certainly object to paying the insurance, and when asked if they would object to paying in case there was a detector meter on the line that let the trash through and plugged the pipes, he answered, "they would not." When asked why his company would pay in the one case and object to doing so in the other; after he had previously admitted, with reference to the local case, that if one of the discredited meters, hereinbefore mentioned, had been on this sprinkler line, it *could* have prevented the débris passing through it and still let enough water through to have extinguished the fire, he hesitated, but finally said in substance: "We would pay in the one case for the reason that the system was equipped with an *approved* meter, while in the other case it is an isolated one and might never occur again, and so could not be reasonably considered in discussing the question."

From the foregoing does it not appear that the efficiency of the meter does not control so much as some other features?

Following an idea suggested by the last above, will say that a number of our manufacturers, who had been notified to place meters on their sprinkler lines, took up the question of efficiency of the different types, and decided that they wanted another meter than the one approved by the underwriters, and took the matter up with one of the underwriters' repre-

sentatives, and in due time were advised, as I remember, that the meter named could be used without having insurance rates raised, but that "They would endorse the policy against circumstances arising from the use of such meter."

This, of course, had the supposed desired effect, and brought an order to the office for another detector meter, as the owners did not care to take the risk on their insurance that such an endorsement might involve, notwithstanding the fact that one of the other type of meters was preferred.

In conclusion will say that while there are other features of the detector meter that might be mentioned for comparison, the writer feels that this one of efficiency, as to water supply, is of the greatest importance at this time, and that, if through this paper, a general discussion and investigation can be brought about that will finally result in municipalities and water companies, as well as individual buyers, having something to say about what meter they will use without being in danger of having insurance policies cancelled, or loaded up with a lot of meaningless clauses, his efforts will have been well rewarded.

Discussion.

MR. CHESTER: Mr. President, with regard to the emphasis laid upon trash, it seems to me that trash is something foreign to what water companies should have in their mains. There are two kinds of water supplies, underground or naturally filtered, and surface water, with which latter I believe the author of this paper has been dealing, and which to be pure should be filtered, and if filtered, there will be no trash in it. That would certainly eliminate a large part of the objection to any kind of meters so far as trash is concerned. The only other improvement necessary is the complete isolation of our sprinkler systems from any use other than that for which they are established, enabling all valves to be sealed, and in such cases the necessity of any meter on a sprinkler system is largely obviated.

MR. GRISWOLD: Mr. President, may I be permitted to say from a fire protection viewpoint, that the insurance companies and the fire protection engineers object to any kind of a meter, and they do not expect to find any water service which is going to carry through it sufficient trash to stop the supply. If any such system of water supply as that should exist we would hesitate primarily to give any credit for the sprinkler system, because we would certainly expect that if the waterworks people permitted trash to flow through their distribution system we would certainly get it in the smaller mains of our sprinkler equipment, and therefore we would be very chary of giving any man credit based upon the idea of his being able to get water through an impermeable wall.

In these days of progress of the waterworks service it seems impossible that anybody should assume that their water supply is filthy or filled with trash, for if trash collects it will stop the service, and then the sprinkler service would certainly be made inoperative. I cannot understand why that position should be assumed. I might say further from the standpoint of a fire protection engineer that we are somewhat in the position of those people upon whom it is proposed by the federal and some state governments to place an income tax to apply to their income from whatever source secured. There is a good deal of a fight on that proposition. Now the insurance companies and the fire protection engineer do not want a meter on the service at all. We want no influences that will tend to retard the

absolutely complete flow of the water supply. Like those upon whom it is proposed to place an income tax, if we have got to be taxed we would rather be taxed with one class of meter than another class of meter. We have approved no meter, but we do say, as we also say in relation to hose coupling, or in relation to a fire pump, that this or that hose coupling, or this or that fire pump that we have examined will do as well as we can expect, considering the retarding influence on the flow of water.

There is no special meter that is put up by the insurance companies as the only "IT;" and if the gentleman who has just spoken has had the misfortune to meet with insurance interests which are so seemingly hidebound and anxious to follow the letter of what they consider the law that they propose to cancel the policy if you put in any other meter than So and So's, they are assuming an authority which is beyond their jurisdiction. There is no insurance organization to-day that manages an insurance company that writes the policy; and the insurance company that writes the policy has the final say as to whether that policy shall be cancelled and for what reason. The only privilege that the insurance agent who issues the policy has with respect to cancellation is upon the discovery of a bad moral condition, or because of non-payment of premiums. No organization outside of the company itself has the broad privilege of cancelling the policy because somebody not controlling the business says it ought to be cancelled. Whoever or wherever these parties may be representing insurance interests who would assume to say, " if you do not put in So and So's meter we will cancel the policy," they do not have the support of the people who pay the loss when the loss comes.

MR. HOUSTON: For the purpose of being fully understood by every member of this convention, and also for the purpose of inducing further discussion by the gentlemen who have replied, I wish to state that I did not intend to make any assertion that could be construed as saying that insurance companies had threatened to CANCEL policies if So and So's meters were used. I do not think that any such statement is made in the paper.

The paper does state, however, that one of our manufacturers, who wanted to use a different meter than the *approved* one, took the matter up with one of the underwriters' representatives, and in due time was advised that the meter named could be used without having insurance rates raised, but that "They would endorse the policy against conditions arising from the use of such meter."

The only statements I have made with reference to the matter are those contained in the paper.

All that water works people want is what is absolutely fair from all standpoints, and I sincerely hope that we will be able to discuss the paper in a spirit of fairness, and without any attempt at the juggling of words, as it is a matter that is mutual between insurance people, the meter manufacturers, the insured and water works companies—both municipally and privately owned.

The paper also says that "One of the representatives of an underwriters' association informed certain members of our council that in case any trash clogged a meter which was put on any sprinkler line supplying any of their risks and a fire should occur in the building so equipped, and it was found that the meter had been stopped by trash, his company would certainly object to paying the insurance."

MR. GRISWOLD: I do not believe that the author of this paper has ever found within a city where the water supply covers the whole property that the insurance companies have ever said that they would not pay a loss unless some particular class of meter was put in.

Mr. President, with your permission, there is a gentleman here who was one of the executive officers of the Boston Manufacturers Mutual Fire Insurance Company, and I would like to hear from Mr. L. H. Kunhardt, if he is willing to express himself on this subject.

PRESIDENT ALVORD: If there is no objection the courtesy of the floor will be extended to Mr. Kunhardt.

MR. KUNHARDT: I feel a little diffident about saying anything, gentlemen, but so far as our particular company is concerned and others in our association, we lay down rules and requirements for the government of our members such as we believe are to the mutual advantage of the members and the companies. It is wholly a question of mutual co-operation as to what is best; we carry that system of mutuality so far that we believe we ought to, and we do obtain the co-operation of all who have to do with the fire protection of any particular plant. Accordingly we lay out fire protection systems such as will give the utmost efficiency under all conditions; and we do know that any device, that may operate as a possible obstruction to a pipe is a hindrance to fire protection. Even a multiplicity of gate valves upon such a system is bad. A multiplicity of ordinary check valves on such a system is bad. A multiplicity of any devices, no matter of what sort, that restrict the area of the pipes is always bad. That is why Mr. Chester said a few minutes ago that the complete isolation of a fire protection system is desirable and proper. In this way the necessity of a meter is obviated.

Now this is the primary thing with which we start. If you can isolate a fire protection system you will not need to put any obstruction upon its pipes. We use our best efforts to keep the system absolutely independent so that it will be under control and you will know where you stand every minute. We try to get all detector devices with just as large openings through them as possible. We place a limit on the smallness of size that we think desirable for fire service connections, especially in large plants and where the values run up into millions of dollars. This minimum is 5¼ inches. One device that is made to-day has a 4¼-inch throat and we have suggested that that ought to be made at least 5¼ inches.

I want to emphasize the fact that we must have a clear and unobstructed entrance pipe into the fire system. Suppose we were to have one hundred sprinkler heads in this room. If you had a device on the entrance pipe which was liable to get plugged up you would hazard the entire efficiency of the whole sprinkler system in this room, but on the other hand if you were to allow simply little pebbles, etc., to get in there, or even a little grass, or a little wicking, or something of that kind that has been dropped into the pipe when they were making repairs in the streets—if you would allow that stuff to come along through the system it would get into the sprinkler heads and would obstruct and block up the little branches in a few places, probably *all the rest of that system would still continue in operation* and *the portion in operation would be efficient.* After the fire was over we might find seven or eight sprinkler heads with little gravel stones or sticks in them stopping up the openings, but that would not mean that the rest of the equipment had not been doing as good service as ever. In hundreds and hundreds of cases sprinklers have done good service as compared with the few cases where the buildings may have burned down due to inefficient water supply or perhaps to some plugging of the pipes. In other words, keep in mind that it is the main pipe that you are talking about when you are considering the placing of a device outside on the six inch pipe, and in that case you want to be very careful to see that there is no possible obstruction. It is the entrance pipes that are far more important than the branches. There is another device that comes along with the ordinary meter that I might speak of, namely, the strainer. The holes in that strainer are perhaps ¼ inch in diameter, and you can see how quickly little particles may enter in and fill up these. It is not only when the fire is occurring that filling up may occur. It may be under certain circumtances that sediment has been collecting for weeks or even months under small consumption, and it is not until the heavy demand comes along that you find the water will not flow through as it should, due to restricted area at the pipe entrance. Because of this the pressure at the sprinkler heads may not exceed 10, 15 or 20 pounds on the first floor, whereas the pressure in the street may be 50 or 60 pounds, and there might be, therefore, no adequate

supply whatever on the floors above. Furthermore, the steam fire engines or hose streams may have reduced the pressure considerably below this, due to the fire, so that the sprinklers in the fourth, fifth or sixth story would perhaps just barely have water enough to supply them on account of reduction in the pressure. Now, in such a case if there is in addition an obstruction in the pipe, the sprinkler heads on the top floor will not receive any supply whatever, and the natural conclusion of the inexperienced is that that particular sprinkler system was not of any account. Strictly speaking, it was not doing any good, but it was not the fault of the sprinkler system, it was the fault of the devices on the bottom of the riser which prevented the sprinkler heads from doing good work, which they otherwise could have done.

MR. GRISWOLD: I have already made the statement that the insurance interests have not issued an edict of approval of any one man's device. Fire insurance engineers and fire protection engineers test all meters, and if the tests show that they obstruct the flow, or if there is trash in the water system and it goes through a six inch connection it will find its lodgment in one branch perhaps, or two or three branches; but it will not cut off the whole supply. Under the same conditions a meter with a strainer or trash collector may shut off the whole supply. I would like Mr. Kunhardt to say for the benefit of members present whether his companies, in which the insured are all members, have issued any edict of special approval of any meter. I do not think it has, but I would like to be informed.

MR. KUNHARDT: There has been no approval given to any meter. There have been circumstances where we have been obliged by the conditions to permit the use of a device on a fire protection system; but unfortunately there are meters on some fire systems in a few places that will cut off 40 or 50 per cent of the pressure sometimes. The current meter that was spoken of is not a circumstance compared with some of the obstructions that are on fire protection pipes in the shape of meters. We do the best we can; we give our members the best advice possible. We ask them to take such meters off for the benefit of their property. Sometimes we put in an additional fire pump. Sometimes we put in new tanks or something of that kind which will give a main supply of water independent of the obstructed source.

With regard to the cancellation of policies, there is nothing a man can do that will invalidate his policy except what has been referred to, increased moral hazard resulting in the likelihood that the man will intentionally burn down his plant. If such a condition could be shown to exist the man could not collect his insurance. Every man is expected when he has a fire protection system in his plant to use his best endeavors to keep that system in order. An unintentional failure to do this on his part or the failure of waterworks to furnish an adequate water supply does not invalidate the policy.

Insurance companies provide against these contingencies of every kind. They provide against lightning, fire, all kinds of accidents, etc. It is the effort of insurance companies to reimburse the policy-holder in the event of loss. You never need fear when you hold an insurance policy that you cannot collect that policy if the insurance company is sound and solvent. Their effort is always to help the man, and on the other hand the policy-holders should help us to keep their risks up to the highest moral standard. If the conditions get so bad at a plant or the hazard so increases that we cannot insure it, we advise the policy-holder; the policy has a clause in it which states that after ten days' notice from the insuring company the policy may be cancelled, and the policy-holder is then obliged under the law to provide himself with other insurance at the expiration of the ten days.

MR. CAULFIELD: I would like to ask if your company does not require three separate systems for water supply, that is, a pressure tank, a storage tank and a direct connection with the water mains? These are required in Minneapolis and St. Paul. I know of firms that have from 8,000 to 12,000 gallon pressure tanks, 30,000 gallon storage tanks, and also direct connection from the water mains. My theory has always been that upon a fire occurring if these tanks are exhausted and

the automatic sprinkler has not put out the fire the building by that time will be pretty well gone. They claim that they require three separate water systems.

MR. KUNHARDT: The matter of three systems is really the outgrowth of conditions. Now as a matter of fact any insurance company will accept two ample sources of water supply. The reason that they wish to have two is that they want to provide for the contingency that one source may be accidentally shut off or out of commission. They want two strings to their bow. The tank may have to be repaired, or cleaned and painted if it is a steel tank, both inside and out, and they want the city water supply to be available during that time. On the other hand, occasional repairs have to be made in public streets and the water has to be shut off, and during that time the tank supply would be available. The outgrowth of the three supplies has been this, I think: Suppose the plant had originally a public water service connection. We will say that there is a 12,000 gallon pressure tank. It has been found that a high pressure service tank with 100 pounds pressure is very limited in capacity, and when you come to pour its water contents on the fire under 100 pounds pressure, the ordinary sprinkler system will consume 15 to 20 gallons per sprinkler head per minute, or say 20 gallons of water as a fair amount to bank on. With fifty sprinkler heads open that would mean 1,000 gallons per minute. A 12,000 gallon pressure tank only holds 9,000 gallons of water, the remainder being air, and that will last only nine minutes when fifty sprinkler heads are open. If only twenty-five are open it will operate for eighteen minutes. Experience has shown that this is not a very long time for the sprinkler to be doing good and efficient service. The effort, therefore, has been to get a little more water, and this has usually taken the form of a gravity tank. Suppose such a tank contains 30,000 gallons of water which will be delivered at the sprinkler heads in the top floor under pressure of 15 pounds. That means at that lower pressure the water will last a longer time. Experience has shown that a pressure of 15 pounds is almost as efficient in a sprinkler system as 25 pounds, but it won't be quite as snappy.

MR. WATSON: What, if any, action do the insurance people take to prevent the consumer from tapping from the fire line.

MR. KUNHARDT: We are always up against the same proposition that you are more or less, of looking after our fire system, and we are doing it continually. We are continually advising against tapping. We are continually recommending taking off these connections when they are found. We know just as well as you do that one of the things that obstructs a sprinkler system is barnacles, rust and corrosion in pipes. You take a ¾-inch or 1-inch iron pipe into a building and run water through it, before long the pipe is corroded and this would make the sprinkler system of no value.

We are just as desirous of having our sprinkler system as free and independent of all kinds of taps as you are, and we are trying to work with you all on that proposition. Any time that any waterworks man ever comes to us and says, "Gentlemen, I want to have a separation made down here in this plant; I am going to require it." We say to him, "We will help you. If it is your rule that you require that, we will be glad to conform to it." We sent out men to try and find out how to make your fire systems as efficient as they possibly can be. There are old systems in many places—I could mention dozens of them—one of them a big plant in the East that is worth $5,000,000. Twenty years ago it was probably worth $1,000,000, perhaps not so much. In those earlier days they made an agreement with the water company. The water company was a private company, and they agreed that they would pay a certain amount for the use of the water. There was no objection in those days to connecting up with a 6-inch fire line; taps were made to the closets in one part of the yard with a 1½-inch pipe. The plant grew all the time until the water that the water company was furnishing amounted to perhaps $2,000 or $3,000 worth, for which the plant was only paying perhaps $700

under the old arrangement, simply an agreement made in writing that they were to pay $700 a year. The water company made up its mind one day that now that they were filtering their water and making it better than it ever was before, that they could not afford to furnish so much water as that at that price, and they notified the company accordingly. They also notified them to take every single connection off of the fire lines and put it on a separate line of pipe and meter the separate line, so that the fire protection system would be independent and unobstructed.

MR. WATSON: I have endeavored in my connection with my water company for ten years to treat the insurance people the best we could. In one case they have asked for a 6-inch line without any obstruction in any way; but I have found in the last three or four months that it is absolutely necessary to have something on that fire line to measure the amount of water that passes through it. In another instance we have a plant that has a 4-inch meter connection and our arrangement with them is that they are to pay us a minimum, and they are charged for the use of the water whenever they need it. They pump their regular supply. Their 4-inch line comes off of our 6-inch fire line. Now for the past two years that 4-inch line has not been opened. It is metered. The other day one of our large trunk lines had to be shut down. We did not suppose that plant was using any water for their boilers from the fire line. It is a long line and passes around through the plant, and the superintendent told me, and I believe he thought he was telling the truth, that they didn't take any water from their fire line; but one of the foreigners that worked for them came over to the other side of the river and told one of our men that at the time our large trunk line was shut down that plant hadn't any pressure under their boiler.

MR. GRISWOLD: How was it that the matter run along for two years and you didn't know it?

MR. WATSON: Because they pumped their own water. They had several sources of supply.

MR. CHESTER: If a company starts out to steal water they will go to some main where there is no meter to show that they are stealing. The fact that there was no meter on the fire line permitted them to connect to the fire line. If there had been a meter on the fire line they would have gone to the main back of the meter. I think that is the way a thief generally does.

MR. HOUSTON: In the paper the assertion was made that the underwriters objected to all except one type of meters. We are digressing from that phase of the question quite materially, and I wish to recur to it and set the matter before you in the proper way. And in support of the assertion referred to wish to present the following extracts from correspondence with insurance men, one underwriter writing in part as follows:—

Against the consequences of the use of the . . . . . meter manufactured by the . . . . . Company, but did not object to the . . . . . meter made by the same people. Would also accept the detector meter made by . . . . . Meter Company, and would object to the . . . . . meter made by the same Company.

Also in said correspondence occurred the following language used by the underwriters' official: My opinion would be that placing either of these meters on would cause the insurers of the lumber to endorse the policies declining liability in the event of a loss being traced to clogging of the meter, and I would certainly advise our people to endorse our policies similarly against the contingency of the exposure affecting the sprinklered buildings.

The mayor and water committee held a conference with an official of the Western Factory Insurance Association.

During the discussion the said insurance official made the assertion, with refer-

ence to a large fire that took place in our city a few years ago which destroyed a large portion of one of our paper mills, that the failure of the sprinkler system to extinguish the fire was due to the fact that the sprinkler arm running into the portion of the building which was destroyed, became plugged up with trash that came in through the city mains, thereby cutting off the supply of water entirely through that branch of the sprinkler system.

He further stated that in their inspection of the system, after the fire, they discovered this "trash" and intended to preserve it, but that through some mishap it fell into a pool of slush, and while they were quite sure that they afterwards recovered it, still none of them were quite willing to positively identify it.

He also stated that if they could have positively shown this trash came from the city mains, the city might have been sued for the full amount of the loss the company met with, which as he remembered was about $90,000.

With reference to fire line services being used for purposes other than that for which they were intended, the speaker wishes to say that we have one company that has been using water through an exclusive sprinkler line, no domestic use being connected with it that we knew of. We installed a meter on the system and after about two days inspected it and found that they had used about 45,000 cubic feet of water through the sprinkler system alone in that time. They had an independent connection entirely for the office building and for the factory.

Following the discovery of the use of this great quantity of water through the fire lines, we started an investigation, and about the first thing that attracted our attention was the underwriters' pump, with which they were supposed to keep up the pressure required by the insurance companies, as their system was not equipped with pressure tanks.

This pump was a very rattly affair, rather antiquated in appearance, and was going full blast. We were told that it worked right along and gave excellent service.

We couldn't understand how such a pump could maintain the pressure that their gauge indicated, and so looked around a little and found a pipe, that came in from an adjoining room, connected with the pipes on the pump.

We then had the gate on the main sprinkler line closed, and the pressure gauge at once dropped to 5 pounds, notwithstanding the fact that the pump kept on working just the same.

The line spoken of we found to be connected with an arm of the sprinkler system in the next room, and they had it connected with the pipe on the pump on which the pressure gauge was located, and so in that way used the city pumps to keep up pressure instead of doing it with their own pump.

After making this discovery, we learned from some of the employees of the company that they had been carrying things on in this way for a long time, and that they had been using water in large quantities out of the sprinkler system in nearly all parts of the mill, having had, according to sworn testimony, as many as twenty-seven connections on the system at one time, these connections ranging in size from ¾-inch to 2 inches in diameter.

They seem to have had the spring in their pressure gauge so adjusted that it would show a pressure of 5 pounds, or more, higher than the system was actually carrying, which would cause a casual observer to conclude that they were maintaining a pressure higher than that of the city pumps, and that if they were using any water out of the sprinkler system it did not come from the city mains, but from their own pump; and by the way, I will say that this is exactly what they tried to make us believe.

By this investigation we discovered the fact that certain parties were not doing what they said they could and would do, as notwithstanding the fact that underwriters' representatives have assured us all along that they were our best detectors, because they had every sprinkler system thoroughly inspected with only short intervals between inspections, and if any irregularities were discovered, that would go to show that water was being used to any extent through the sprinkler system

for other than fire purposes, or that the equipment was inadequate—or out of order, they could and would under the contracts cancel the policy of such a risk, they have permitted the conditions which prevail at this plant to exist, and still they did not cancel the insurance or notify our city authorities of what was going on, and give us a chance to put a stop to this flagrant and illegal use of water, although the city was suffering from a scarcity of water at the time of the discovery, and had been for a long time previous.

The insurance companies succeeded for about ten years, in their effort to make our city councils believe that they were, on account of their requirements and rigid inspections, which I have just alluded to, better protectors of the city water supply than were meters, and it was only by a majority of one—the mayor having decided a tie vote of the council—that meters were finally forced on fire lines.

MR. HAWLEY: It is evident that the paper under discussion confuses the functions of the two classes of meters, the detector meter and the current meter.

If a manufacturing plant is being supplied through one pipe for industrial purposes and also fire protection, there is the place to set a current meter. If our insurance friends do not like it so much the better. They will bring influence to bear to take the fire protection off the shop supply and put it where it ought to be, on its own separate line. A current meter is all right for shop supply under certain conditions; but when fire protection is taken from one line that line is no place for the current meter. It is not built for that service, while the detector meter is built for it.

We do not need to measure the amount of water used for putting out a fire; we do not care for that. What we want to know is whether any water is taken "surreptitiously" from the fire lines, and that we can find out by the detector meter; whereas the current meter, especially the larger sizes, may allow considerable water to pass without any registration. There is a service for which each class of meter is suited, but neither can do what the other is designed to do.

MR. REIMER: Since the question has been raised by the paper read by Mr. Houston as to the methods used by the various insurance companies, I would state that some time ago in studying this question of fire line meters I found some peculiar cases which seemed to be contradictory of some of the claims made by the insurance companies. In a comparatively limited area I examined a number of fire line connections of various kinds and sizes. In the first half dozen cases investigated I found that the insurance companies were accepting the following conditions: Two lines were equipped with detector meters and large branch lines, the branch lines being fitted with ordinary current meters for measuring the normal use of water on the premises; two were found with sealed valves controlling the fire lines, that is, the valves on the fire lines were closed and sealed with the water department seal, these apparently acting just as well as detector meters, yet those lines were actually sealed against the passage of water, supposedly protecting highly valuable property with heavy risks involved; of the last two of the first six lines examined one had no valve or meter controlling the line and the other had been passed by the insurance company in the following condition. The 4-inch fire line coming into the main building carried a 1½-inch branch line. The department finding that the piping throughout the building had been so arranged that there was a connection between what was supposed to be a fire line service only and the regular service line, simply put a 1-inch meter on the 4-inch line which was supposed to be for fire service. Yet that condition was accepted by the insurance company.

I did not go very much further in the investigation, deciding that if the insurance companies were willing to accept such conditions under their policies there was not very much use for worry on the part of the water department, so we simply adopted a certain policy and have pursued it regardless of what the insurance companies did or wished. If these companies will accept such condi-

tions as we found in one small district I cannot see how they can raise much objection to what any water department may do.

MR. N. S. HILL: I feel that the water department should be equally interested with the insurance company in trying to provide the best and most adequate fire protection; on the other hand, I feel that the insurance people should co-operate with the water department in preventing the meretricious use of water. Unquestionably there are to-day numbers of so-called fire lines from which connections have been taken. I have run into a number of them; and in some cases these connections have spelt the difference between profit and loss to small water companies. In taking up this matter it should not be a question of what the insurance companies have allowed or what the insurance companies have overlooked—but rather a question in which both the water company and the insurance company are vitally interested; viz., adequate fire protection with an assured revenue. The water department can co-operate and notify the insurance companies of conditions such as Mr. Reimer has described; insurance companies can act as a co-operative agency by notifying the water department whenever they discover the surreptitious use of water. Co-operation of this kind would tend more than anything else to establish a mutual understanding which would bring about that which is desired by all, namely, fire protection, complete and perfect as it may be made consistent with the safeguarding of the water department from those losses which every practical waterworks man knows to exist.

So much for co-operation. On the one hand, meters on fire lines are absolutely essential in order to minimize the operating cost of the water department or water company and in some cases are even necessary to prevent losses to small works which mean financial ruin. The insurance companies must not impose conditions which cannot be met with in the practical design of a fire service meter. Meters may have been designed which will minimize the danger of stoppage and the insurance companies should take a rational view of the meter question.

On the other hand, the type of meter is of the utmost importance; and while at first I felt somewhat doubtful about the insistence of the insurance companies upon a type of meter which would do away with any restriction of the pipe opening, I have in looking into the matter found that the demands are reasonable from an insurance viewpoint, and I believe that there are enough cases in which overalls, pick handles and other implements, pieces of rock and hemp have been left in the pipe, causing serious trouble and stoppages, to justify the statement that it is certainly important that a meter or device which is used in a fire line should not be a trash collector. I think that the water companies should co-operate in helping the insurance companies to get the type of meter which they desire; and the meter companies should go to work and develop meters which will meet these conditions. It will not be long before the differences on the subject of fire service, which have existed between this association and the insurance companies, and which have been under discussion for a number of years, will be settled.

MR. KUNHARDT: I wish most heartily to thank the gentleman who has just spoken, for his remarks, which are along the right line and represent just what we are trying to do. This proposition is a mutual one, there is no question about it; and there is also no denial but what obstructions do occur in pipes, we want to keep out any and all obstructions, whether they are overalls or something else. In Springfield, Mass., we found a 6-inch pipe going into a factory was obstructed. When we came to test it we could not get any water through it. In the endeavor to ascertain what the trouble was, we found something that would have operated against the detector or anything else. The 6-inch pipe came in at a right angle bend. We found a 6-inch log of wood there as large as the pipe. It had been stuck into the pipe when the workmen left off work one night, and when they commenced work the next morning they left it in, and went ahead. It was a piece of wood 2 or 3 feet in length. It floated along till it came to this elbow, beyond which it could not go, because it could not turn around the corner. Such cases of pipe

obstruction occur in one way or another. And all of the fire protection engineers who can rightfully claim that title will co-operate in the matter of the proper arrangement of fire service connections. If they do not they are not fire protection engineers in the best sense.

There are many plants where for years and years they have been following old rules and regulations, and when the water department wants to change those things they have only got to say the word. In that case where they were found to have been using 45,000 cubic feet of water it would have been easy enough for the waterworks people to have been aware of that fact five years before even without putting a meter on. They could have found it out in many ways; by shutting and closing gates around in different places. The city of Lowell waked up one morning and found they had no water in their pipes at all. They hunted for several hours and finally discovered the leak in one of the mill wheel pits where a main had burst and was discharging into the Merrimac River. They didn't need a meter to find that out. Such losses you can always locate. As insurance people we want to help you, because we do not want this large use of water off of the fire protection lines.

MR. THOMAS: I want to correct one statement which the gentleman just made in regard to the city of Lowell waking up one morning and finding no water in its pipes. I have been connected with the waterworks there since 1887. I am perfectly familiar with the history of the water department from its very origin; I desire to say that there is no foundation at all in fact for that statement.

MR. KUNHARDT: I am going to make just one qualification of that statement, namely, that it was either Lowell or Lawrence. It happened many years ago, if I remember correctly. The story came to me from people who knew of it and who had lived in the place. Possibly it might have been Lowell, but it was either one or the other of those two places. They waked up one morning and found the water gone in the reservoir, and they did not know where it had gone.*

MR. THOMAS: We have a 30,000,000 gallon reservoir at Lowell, and Lawrence has a 40,000,000 gallon reservoir. I think it might have occurred with the company that was furnishing private fire connections for some of the mutual insurance risks. They had a little reservoir that held about 1,000,000 gallons. I know that was emptied after one fire; which would have burned down several mills if the city of Lowell had not come to their rescue and furnished water for sprinklers and hose.

MR. KUNHARDT: You see that we need the city water, gentlemen, that is just what we do need.

MR. E. E. DAVIS: In a distant city, a great many years ago there was a large mill fitted up for fire protection with a 4-inch pipe and 3-inch outlet. The valves were the old-fashioned plugged cocks and opened with a lever. In those days they did not know what hose valves were like such as we have to-day. They invited the press and the public and everybody else to come down and see the grand fire protection they had there that would enable them to flood each of the floors. After the people were all assembled the men at the place were told to open the valves. When they went to open the cocks they found they had forgotten to grease the valve, and four men could not open one of the cocks.

Some years ago we had trouble with the insurance company who said they wanted the fire lines to be not metered. The chairman of our water committee said, "What does our superintendent say?" I said, "He wants meters on the fire lines." The chairman said, "What sort of a meter?" I replied, "Any good one that is acceptable to the water department; if the insurance company will tell me what kind of a meter they want I would be glad to take it up; but so far as I am concerned I require a meter on that line."

*Note by Mr. Kunhardt: Upon investigation I find this incident occurred on the Lock and Canal system, which supplied water to the manufacturing district and was not a part of the city waterworks at Lowell.

In the first place, when a line is put in it is expected that there are no connections allowed on that line except for fire protection, and in the second place, that no water is to be taken from that line except for fire purposes, and that a separate line with separate connections shall be laid for domestic use, so we can see that they do not use any water off that fire line. Several years ago there was a mill at Richmond with a tank on the roof supplied from the city service, the tank supplying the sprinkler system. The roof caught afire and burned up the tank.

The waterworks people endeavor in so far as they can to see that the contractors carry out their contract as to the proper street connection. In one case there was a large mill fitted up with a 3-inch fire service that we required metered. When the meter was set the pipe extended up to the wall, and the contractor was to put it through the wall and connect with the pipe on the inside; but for some reason he never did connect it up on the outside but simply put a block behind the flange, and fastened the block up against the wall, and they tested out the fire lines from the smaller pipe with which he connected. Several years afterwards when the mill burned down we found that the pipe had never been connected through the wall.

We have had some peculiar experiences down there. We have a fire department chief with whom I worked in unison. We have an ordinance down there that requires that if a water bill is unpaid the water shall be shut off the premises. This necessarily shuts off the fire connection as well as the domestic supply, and whenever this is done the chief of the fire department is notified. On one occasion a theatre there failed to pay their water bill for water consumed through their domestic supply. There being no water registered on the fire line the man told me that I could not shut his water off because it would interfere with his fire protection. I told him that the water would be shut off unless the bill was paid. He continued to refuse to pay his bill; so I sent a man to shut the water off of both the domestic and the fire line, at the same time notifying the chief of the fire department, who in turn notified the management of the theatre that he could not hold any performances there until the water was turned on his fire line. Of course it was only a short while before he sent up a check to the water department for the amount of his bill.

MR. GWINN: I heard of a place where they depended upon a sealed valve in order to protect the water company. They had it in a nice little brick pit with iron cover. The waterworks inspector was in the habit of looking into the pit and concluding that the valve was sealed; one day they got a new inspector, who decided to examine a little bit closer than that, and he found that it was sealed all right, but that they had sawed off the stem of the valve just above the stuffing-box and had opened it, and so far as all appearances went it was still sealed, but nevertheless the valve was wide open.

Now as to the question of locating meters on fire lines, I thought that had gotten beyond the debatable stage. I prepared a list three years ago of over one hundred cities where they are using meters on fire lines, and I am a little surprised that anybody in this day and generation would be willing to supply a fire line without placing a meter on it. I would not think of supplying any more fire lines unmetered; but there is a concern out at Terre Haute that have solved the question in such a way that it is not necessary to put any meter on. They have solved it so there is no danger of contamination, from the factory supply. The concern I refer to has solved the difficulty in its own way. It provides its own water, pumps it out of the ground and has its own tanks up on top of the building and does not have to get connection with the waterworks system—and I am mighty glad of it! We are a great deal better off without those connections than we are with them; but if we are going to have them, I would not think of having them without meters.

MR. E. E. DAVIS: We do not allow a connection between the domestic supply and the tank supply.

MR. DIVEN: I supposed that this question of meters on fire lines was settled in 1904. In 1903 we invited the insurance men to co-operate with us. We finally convinced them that there was such a thing as "mistaken" connections to fire lines—I will not say "stealing," but some employee would make a "mistake" and connect to the wrong line. We had a conference with them at two conventions, and finally adopted a detector meter as being mutually satisfactory. I am sorry to learn now that the detector meter is not satisfactory; but if the insurance people who are not satisfied with it have anything better to offer they will find this association ready to co-operate with them; or if they want to take the matter up again at a joint conference we will be glad to meet them at any time.

MR. BLAUVELT: It would seem fair to point out a wider range of facts applying to the general subjects mentioned therein, upon which this paper elects to be silent.

There is no necessity for fire underwriters doing business on the basis of city water supply at all. This is a matter for the property owner to choose and be governed by his own views as to the cost.

A minimum rate and preferred contract form, however, cannot be obtained from any class of insurance unless it carries with it precisely the conditions which that insurance prefers.

Anything over and above this must be paid or be waived for precisely as in all lines of business.

It is true as remarked by Mr. Kunhardt that the fire offices of greatest experience do object to trash-catcher meters and do prefer to have the trash from the city mains come through a straightway connection and into the private mains at the risk of plugging up the sprinkler branch piping.

There is a long list of points which have developed in wide experience showing why this is the wiser course, however foolish it may appear from the view of a limited and local experience.

If the trash is permitted to come through it can be and is gotten rid of largely by blowing out hydrants or by opening up piping at periodical inspections.

Passing over this we always have the common law principle that whoever introduces a specific danger in company with a service and accepts pay for the service thereby becomes also automatically responsible for said danger accompanying said service, and particularly where it can be shown that the service was not rendered under the best possible state of the art.

This is why insurance interests at all times hold the right of subrogation as against any water works that may introduce a trash catcher into the fire protection line or should the trash catcher be placed in the fire protection line under authorship of the property owner, then the same legal principle is an offset against full payment of loss under circumstances of an obstructed meter.

Most cases of insurance friction with waterworks arise from hasty action or a limited and local view of the subject.

The general subject of water supply to sprinkler systems is much beclouded by the idea that insurance companies desire to dictate when they are simply declining added risk under their natural commercial interests, and heartily wish same could be left alone.

It is never fair, nor well informed, to treat public water supply in relation to private sprinkler system service as if it were merely a meter question, nor without bearing in mind at least six general considerations along the following lines:—

No engineering nor fire insurance rate necessitates the use of public water at all.

City or public water is preferable only from property owner's point of view, and then only when obtainable at less cost than the interest and up-keep charges on a second source of private supply, the property owner being accustomed to provide one private supply irrespective of the use of the city water.

In the case of an nmetered connection furnishing pressure service to a

sprinkler equipment carrying domestic excess pressure, for example, the hundreds of equipments which have pressure tanks (which make water stealing wholly uncommercial on the part of the property owner) it is not fair nor good engineering to force any kind of detector or meter on the fire line.

A narrow or onerous rule as to meters and charges may have, and in important instances has had, the effect of causing property owners to completely sever their water department relations.

A minimum insurance rate, and what is far more important, the most free and desirable form of insurance contract, must not be looked for unless the insurance interests be given their choice as to how the question of trash shall be dealt with.

Insurance treatment of engineering questions is by no means confined to apparent acceptance or rejection of the conditions and is never a safe subject for opinion in a given case without a full knowledge of rate, contribution, adjustment and subrogation rights under the contract.

Discharge Characteristics of Automatic Sprinklers.

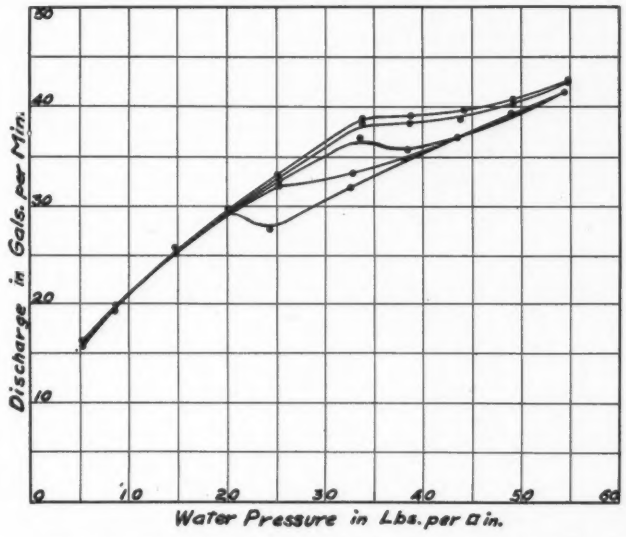
By Fitzhugh Taylor (Member N. F. P. A.)

(Extract from *The Armour Engineer.*)

Sprinklers installed in the lower stories of sprinklered buildings are necessarily subjected to heavier water pressures than those in the upper stories, because of the greater gravity heads impressed upon them by the column of water in the feed pipes or risers. The fire hazards, however, are not necessarily more severe in the lower stories, and in fact the reverse may be true in many instances, and if sufficient pressure is provided to produce effective discharges at the highest line of sprinklers these rates of discharge must be considered adequate as well for any of the lower floors, and the excess deliveries caused by the heavier pressures in the lower stories may be fairly counted as wasteful of water. This extravagance in the use of water on the lower floors is not considered of sufficient importance to warrant the complication of apparatus which would be involved in the use of automatic pressure-reducing valves or of sprinklers of varying orifice diameters, but a thesis recently completed by students of the Department of Fire Protection Engineering at Armour Institute of Technology suggests an interesting possibility which may be worthy of investigation over a range of conditions wider than that already covered.

The thesis in question included as one of its divisions the determination of discharge characteristics of a group of sprinklers of a selected pattern, these sprinklers having been made especially for the tests. They differed from ordinary sprinklers and from each other in the lengths of the shoulder at the orifice. The discharge characteristics of these specially formed sprinklers are shown in the accompanying cut. The explanation advanced

for the aberration of the curves was that at the lower jet velocities the efflux coefficients were influenced by the diameter of the waterway down stream from the shoulder, and at the higher velocities principally by the contraction from the shoulder. It was found that the longer shoulders required higher velocities than the shorter to produce the aberration.



Discharge Characteristics of Sprinklers Differing in Length of Shoulder at Orifice.

The results of these tests have suggested the thought, not as yet confirmed by experiment, that sprinkler nozzles designed with two or more shoulders in the waterway might be found to show corresponding points of aberration under continuously increasing pressures, and that such sprinklers, showing several depressions in the discharge characteristic, would be less extravagant than those at present used in their consumption of water in the lower stories of high buildings, and would at the same time yield in the upper stories the efflux coefficients which are now accepted as standard. This theory is advanced with some diffidence, and with the thought that it may provoke further experiment.

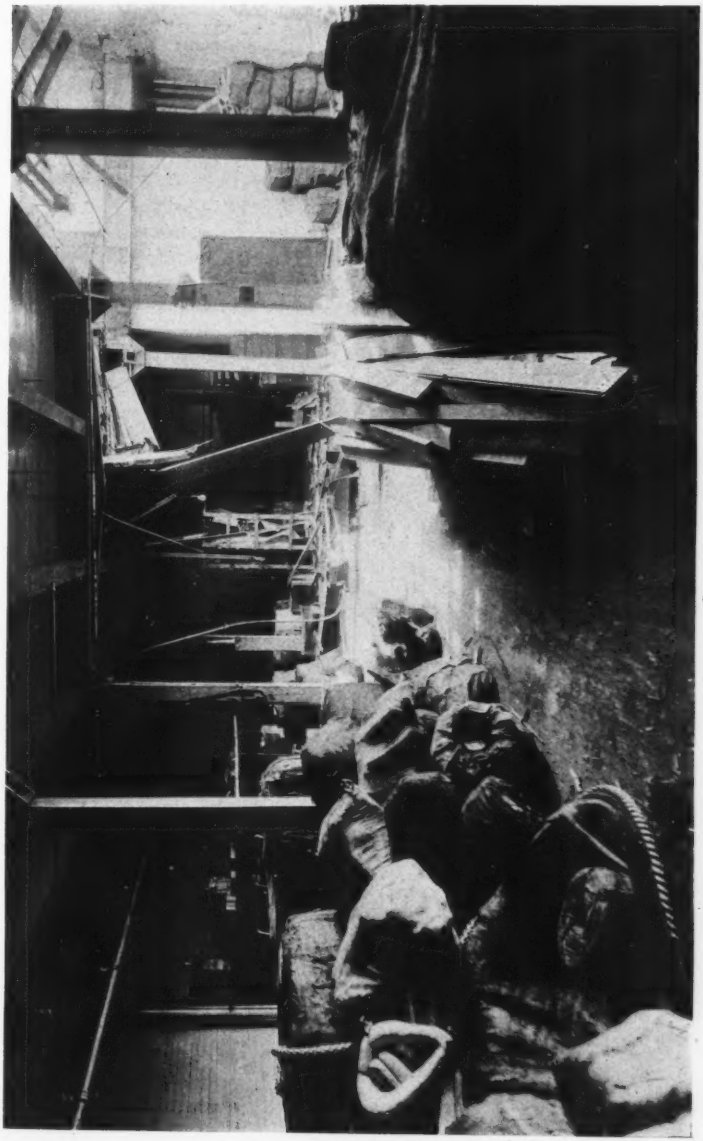
Sprinkler Tank Failures.

The following accounts of the collapse of four sprinkler tanks are given because of the importance of proper construction and support of such tanks.

The collapse of these tanks emphasizes anew the importance of all plans for supports of tanks being passed upon by competent engineers. Tanks directly over buildings are at best a menace to life and property, and the greatest care should therefore be taken in building and maintaining the supports. If it is necessary to locate such tanks upon buildings, they should be placed upon a properly designed and constructed tower, such as an elevator or stair tower, and supported directly on solid masonry. Such foundations should be originally designed by experts to carry the weight of the largest tank which the fire protection apparatus may require. In other words, the fire protection engineering should go hand in hand with the architectural and structural engineering, not being left as a matter of chance or after-consideration.

S-11721. September 29, 1911. This was a wooden tank of 20,000 gallons capacity, poorly located on wooden trestle directly above roof of building and about half way from center of building and east wall. The tank trestle was about twenty feet high and supported on wood columns of building. The building was five stories high with brick pilastered walls. The pilasters were thirty-three by fifty-four inches, spaced approximately fifteen feet from center to center. The curtain walls were thirteen to seventeen inches thick. Roof consisted of boards on joist. Floors consisted of three-inch double plank on timber. The main girders parallel with the shortest dimension of building were built up of two beams, with air space between, and were spaced about fifteen feet on center. The beams were supported by girders by means of stirrups, and were spaced about five feet from center, at right angles to main girders. Timbers extended into wall and were not self-releasing. The columns were of timber and were continuous from basement to roof.

The tank trestle was originally designed for a 7,500-gallon tank, with a safety factor of eight. The original plan was altered and a tank of 20,000 gallons capacity installed. The architect claimed that there was a factor of safety of four with that load. This was November 28, 1906. At that time, however, the structure was reported as weak and in need of additional bracing before tank was filled. The trestle was supported on four columns of the timber framing of building, and the whole was reported as of rather doubtful integrity. The owners were induced to remedy this condition, and engaged the services of an expert. The pine wood trestle was strengthened to carry load of 20,000-gallon tank, with an ample factor of safety.



S-11721.

S-11721.

About 7.30 o'clock in the evening the trestle gave way at base of the two posts on south side, and tank crashed through all floors of building. A section of the brick wall, about seventy-five feet high and thirty feet wide, burst out, owing to the enormous flood of water which came from tank when it fell. Wall was fractured in portions of the three upper stories. Moderate water damage resulted from tank supply emptying into building.

Previous to this collapse a small fire had occurred among some paints and oils stored on the fifth floor, and the fire department was on the premises. About twenty minutes after tank fell, a slight explosion took place in debris and caused another small fire. This was probably due to paints and varnishes which had previously caused a fire, and in falling with tank came in contact with deranged electric wires.

The weather conditions were normal outside and this disaster could not be laid to wind pressure.

An examination of the posts of trestle showed a very rotten condition, and this was undoubtedly the cause of failure of trestle. The rot appears to have originated from the heart of posts and worked outward. The outside surface was well preserved by paint, and the fact that the trestle was not sound could not be detected by the eye. The reason given for the trestle being more rotten at base than elsewhere was that more moisture reached the heart of posts at this point, due to possible crevices around bolts that were used in securing braces to posts, etc., thus causing this part of posts to decay faster than the rest. The heavy construction of building undoubtedly obviated a more serious loss.

S-12481. October 3, 1911. The buildings were 3 and 4 stories and basement, brick and stone structures, equipped with automatic sprinklers having as primary supply connections with two city mains and as secondary supply a 20,000-gallon wooden tank located at the rear corner of the 3-story and basement stone building occupied as a wholesale grocery warehouse. The walls of this building were 30 inches in thickness in the basement and 24 inches in the three upper stories, frame joist interior with double 1-inch board floors and gravel roof of 1-inch boards. Adjoining on one side was an unsprinklered building of similar height and construction occupied for wool, rags and miscellaneous storage. Blank wall between the two buildings with a 2-foot parapet.

The tank was erected in 1906 and rested on a steel trestle 34 feet high. This trestle was constructed of 6 x 6 x ½ inch angle iron with horizontal cross pieces of 4 x 4 x $\frac{5}{16}$ inch angle iron spaced 11 feet apart and with ¾ inch tie rods running diagonally between the cross pieces. The legs of the trestle were 16 feet apart at the bottom and 14 feet at the top. The two westerly legs were supported on the rear wall of the building, being bolted to stone caps 20 x 20 x 16 inches, laid on top of the wall. To support the other two trestle legs, columns were carried up through the entire height of the building, being 10 x 10 inch Georgia pine timbers, end on end, resting on concrete foundations in the basement and bolted to the joists where passing through the floors. These columns projected through

the roof and where exposed to the weather were encased in tin and surmounted by 10 x 10 x 1 inch plates to which the trestle legs were bolted. At the top of the trestle were two 15 inch I-beams and across them were laid 2 x 12 inch wooden joists, and then the wooden chime joists directly against the bottom of the tank. The tank had been painted and calked twice since its erection.

S-12481.

No evidence was obtainable as to whether special permission had been secured from the city before the tank was erected or that the method of supporting same had received the approval of an architect. The tank with its 20,000 gallons of water and the trestle represented a weight of approximately 180,000 pounds, or 90 tons.

The Collapse. On October 3, 1911, at 2 p. m., an employee working on the shipping platform in rear of building noticed mortar falling from the wall directly under the tank, and he immediately ran into the building shouting a warning. Within a very few moments the crash came, but the two northerly trestle legs having buckled, the tank carrying the trestle with it, pitched over on the roof of the unsprinklered building adjoining on the north. The tank evidently held together and tore its way through the roof and the three floors of the building, and when the debris in the basement was examined, the hoops were found still about the staves. The tank riser was broken at the roof, and while the water had been partly turned off when the first warning was given, there was considerable water damage to stock, but comparatively little damage to the building itself.

The stock damage in sprinklered building amounted to $6,737.06. The damage to building was about $400 to $500, and tank and supports about $1,500. The loss to and in the adjoining building which received the full impact of the falling tank was estimated at about $10,000.

When the tank fell the thermostat and sprinkler alarm connected with the fire department station operated in proper manner, and an alarm was

also sent in by one of the employees. The Department responded promptly, but fire did not ensue, and fortunately there was no loss of life.

An examination of the tank supports showed that the northerly wooden column had been considerably affected by the weather, showing signs of deterioration and had broken off about four feet from the top. The wall under the northwest trestle leg had also given way, whereas the two southerly legs had merely pulled away without special damage — aside from splitting the stone cap on the wall and pulling out the bolts from the wooden column.

After the collapse of the tank the Fire Chief and the Building Inspector reported to the Board of Control that upon examination one of the wooden supports was found to be rotten at the top, water having leaked in at the foot of the trestle leg and caused the decay which was not noticed because of the covering.

It was impossible to obtain accurate information regarding the velocity of the wind at the time. However, judging from data available, it was probably not sufficient in itself to seriously affect the tank, yet in conjunction with the damaged column the strain was too great for the weakened support.

The falling of this tank emphasizes anew the importance of having all plans for supports passed upon by competent engineers, and also that where anything in the nature of a trestle is required the work should be designed by experts, and the use of wood in the structure strictly avoided.

S-12481.

The accompanying cut shows the wreck of the building (unsprinklered), with the steel trestle lying across the parapet wall and roof in such position as to indicate that the wooden support under the northeast leg had given way and that the tank pitched forward in a northeasterly direction, and would seem to confirm the assumption as to the cause of the collapse.

December 27, 1911. The mill was originally two stories in height with walls of stone about twenty-four inches thick, and occupied as a cotton spinning mill. The present owners, manufacturers of linen thread, had reconstructed the building, put in new floors and added another story. A new fire escape and elevator tower was built in one corner of the building, the inner walls of the tower being built from the ground, but the outer walls were built on the old stone walls. All of the new construction was very heavy.

A new sprinkler equipment was being installed and the specifications called for the tank to be twenty-five feet above the highest line of sprinklers. The tank was 20,000 gallons capacity and situated directly over the front part of the tower. The new sprinkler equipment was complete with the exception of boxing tank connections and the sprinkler men were engaged in doing the work when the crash occurred. One of the fitters was killed, and one was taken to the hospital with a fractured skull. Just a moment before the fall of the tower, several women employees in the lower story heard a rumbling sound, and they had sufficient time to escape from that part of the mill. The foreman of the sprinkler gang reported that the tank was filled to about six inches from top of overflow pipe, and that there seemed to be a momentary pause between the bulging of the lower walls and the falling of the upper part of the structure, the tank connections forcing the tank bottom upward and outward. The walls of the older portion of the building appeared to have been rather loosely built of small sized stone laid and plastered with inferior mortar, the mortar being of a light yellow color (probably a very large proportion of sand) and powdery from age. There were window openings in the old wall, and it is stated a new doorway had been cut through from the lower part of the tower, and the added weight of the new third story and roof, together with the high tower and tank simply crushed masonry that was never intended to bear any such burden.

S-11977. The new 25,000-gallon sprinkler tank on steel trestle above 3-story brick tower between 1-story and low basement, finishing and packing building, and 3-story finishing building, at southeast corner of plant, fell December 7, 1911, at 12.25 p. m. Tank, followed by the steel trestle which had supported it, fell to the west and crashed through the roof of 1-story finishing and packing building, crushing in the roof for a distance of 25 feet from east end and half the width of building and wrecked the south wall of packing building for a distance of 33 feet from east end. A considerable stock of finished table tops stored here was buried in the ruins and sprinkler lines broken off under roof just east of the 3-inch riser.

After the collapse the greater part of the tank was found in what was formerly the 11-foot open space between packing building and 2-story finishing building to south, and about 15 feet west of foot of brick tower; most of the tank fell together, with the staves laid side by side as though they had been piled by hand, and with many of the round iron hoops

piled in almost concentric rings, lying on the staves. Part of the brick wall (originally the west wall of tower) was on top of tank staves, burying the staves in great part, and the 14-foot 4-inch steel trestle, which originally carried tank, was on top of this pile of bricks, close to wall of tower, and turned completely upside down, with the exception of one of the legs of trestle, which remained right side up, near wall of tower. West wall of tower was crushed out for a distance of approximately 28 feet from the top.

The heavy frame work, consisting of two 15-inch steel I-beams, 19 feet long, tied together with two 10-inch steel I-beams, 10 feet long (and set 10 feet apart), which supported the yellow pine stringers upon which bottom of tank rested, was pulled loose from the top of trestle and now lies close to west wall of tower, under the wreck of trestle itself, and upside down. Most of the bottom of sprinkler tank was found at ground level inside of brick tower, and it appeared that when tank fell the heavy 8-inch pipe, or outlet from tank, pushed up the bottom of tank, probably bursting the bottom in several places, this wreckage and most of water in tank pushing its way down through the floors of tower.

Sprinkler tank was made of cypress wood (apparently), staves being 18 feet long and 3 inches thick; bottom was 2¾ inches thick. Tank was 16 feet 9 inches in diameter (inside) at the bottom, and 16 feet 3 inches diameter (inside) at the top. Cone cover and inside flat cover. As nearly as could be determined there was no walk way or platform around tank. Staves were held together with the usual number of good round iron hoops.

Description of Brick Tower. The tower and trestle which supported sprinkler tank were constructed as follows: Tower was of brick, the north, south and west walls being 21 inches thick from ground, up to a point 11 to 12 feet below steel work of trestle, where wall was reduced to 17 inches; east wall of tower was formed by the west wall of 3-story cabinet and finishing building, which was 17 inches 1st floor and 13 inches above 1st floor, all the way to top of tower. Tower was completed about a year ago and 3-story cabinet and finishing building prior to that time, so that it was necessary to tie north and south walls of tower into the 13-inch west wall of cabinet and finishing building; this was done by tying one brick of each course in tower wall, into a pocket about 4 inches deep, cut in wall of cabinet building, and while this was not a very strong bond, no trouble was experienced here. Tower walls were built of ordinary brick, and were evidently of the quality used in the construction of the other buildings of plant. While not hard brick, they were of a fair quality.

Walls of tower were laid up with a mixture of Portland cement and sand, sand being obtained in the neighborhood. This sand was of a deep brownish yellow color, but was said to be sharp and is used extensively for local building purposes. Mortar was mixed by hand, and construction work was done under the supervision of owners, not by contract.

From the appearance of fallen pieces of wall it would appear that mortar was not mixed evenly, some of the mortar being very hard and at other points being easily broken by the hand. It also appears that brick work was put up with the bricks somewhat dry so that water in the mortar was

S-11977.

Collapsed wall of tower fell outward. Character of the brickwork and wreckage inside of the tower can be seen.

absorbed rapidly and this prevented a good bond between mortar and bricks. Taking all these circumstances into consideration, however, tower was amply strong to have carried the weight of tank and contents, trestle, etc., were this load distributed properly. Tower was parapet 18

inches above roof, but parapets were not coped and there were no channel or I-beams on brick work supporting the steel trestle which carried tank.

Description of Steel Trestle. The steel trestle was composed of standard steel angles with equal legs and $\frac{7}{8}$-inch rivets, spaced $3\frac{1}{2}$ inches on centers, used at all the principal joints. The four corner posts were of 6″ x 6″ x $\frac{1}{2}$″ angles, all other members being 3″ x 3″ x $\frac{1}{4}$″ angles. On the bottom of the corner posts were steel bearing plates, 14″ x 14″ x $\frac{1}{2}$″, which were connected to the posts by angle iron connections in the usual

S-11977.

Steel trestle as it lies in east end of one story and low basement packing and finishing building. Door into tank tower shown on the left.

way and which rested directly on the brick work and were anchored to it by means of two one-inch bolts, seven inches long at each corner. All the members of the trestle were single angles except the top and bottom horizontal chords, which were double angles, back to back; therefore all rivets were in single shear except in these horizontal chord members, which were in double shear. The trestle was braced laterally by single 3″ x 3″ x $\frac{1}{4}$″ angles connected horizontally from corner to corner in the plane of the lower chords, which was about 18 inches above the bottom of the corner posts, and these angles were attached to the lower horizontal chords by means of two $\frac{3}{4}$-inch rivets spaced $2\frac{1}{2}$ inches on centers.

The corner posts or compression members were 20 feet apart at the

bottom, where they stood on the brick work and only 10 feet apart at the top and were approximately 14 feet 4 inches in length, so that their inclination from the perpendicular was somewhat over 20 degrees, which of course would increase the stress in them. The horizontal chords and diagonal members were attached to the corner posts at a point approximately 18 inches from the bottom and from the top of these posts, which, as the posts stood at an angle of about 20 degrees from the perpendicular, introduced a very considerable bending moment into the posts, in addition

S-11977.

Shows the 14 x 14 inch bearing plate, bent up at inside corner, in lower left hand. Gusset plate, which tore off, is near top of illustration. The heavy frame of two 15-inch I-beams and two 10-inch I-beams connecting show at the left. Tank staves and concentric hoops show at right center.

to their regular loads. Across the top of the corner posts rested two 15″ x 5½″ I's, 19 feet long (one on each side) connected by two 10″ x 4½″ I's ten feet apart, over the tops of the corner posts. These I's carried the timber grillage which carried the tank.

At the time of the accident it is understood that there were approximately 20,000 gallons of water in the tank.

Assumed Loads at Time of Accident.

TABLE No. 1.

	Pounds.
20,000 gallons of water	166,000
STEEL TRESTLE.	
58 feet of 6″ x 6″ x ½″ L's at 19.6 lbs. per foot	1,040
378 feet of 3″ x 3″ x ¼″ L's at 4.9 lbs. per foot	1,840
38 feet of 15″ x 5½″ I at 42.0 lbs. per foot	1,595
20 feet of 10″ x 4.66″ I at 25.0 lbs. per foot	500
Plates, rivets, etc.	1,000
12 feet of 8″ pipe, etc. (tank drop) and timber grillage	1,500
Tank	7,600
Total load on brick tower (no wind blowing)	181,175
Load on each corner (divide by 4)	45,294

Each corner post, therefore, according to the above assumption, was carrying 45,294 pounds, and this load was distributed over the brick work by the 14″ x 14″ x ½″ bearing plates. The area of these plates, 14″ x 14″ equals 196 square inches, and dividing the load by this area we have 45,294 divided by 196 equals 231 pounds per square inch on the brick work, which is far in excess of common practice. The brick was laid in a concrete or cement mortar, but a nail could be easily driven in between the bricks in the part of the tower still standing. The mortar seemed to be a little harder than the lime mortar in the walls of the adjacent building. The maximum allowable load per square inch for common brick work is 100 pounds per square inch; for good hard eastern brick work in lime mortar, 120 pounds per square inch, for extra hard brick work in cement mortar, 150 to 200 pounds per square inch, and for good Portland cement concrete, 200 pounds per square inch.

It will be noticed that the brick tower measured on the outside, 21′ 4″ on the east and west direction and 22′ 6″ north and south. The bases of the corner columns being 20 feet apart, they would fit the corners of the tower in the east and west direction with about an inch of brick work at each side of the bearing plates, but in the other direction the tower would be too wide and the bearing plates would set out onto the 13″ wall (which is the east wall of tower), and lap over onto the north or south wall, as the case may be, only 2 inches. This would reduce the bearing surface to only 184 square inches. The trestle may have been made to fit the tower, but from measuring the wreck it is thought that the trestle measured only 20 feet at the bottom, bearing plates in the north and south direction. If one corner, then, had a bearing of but 184 square inches, the load per square inch on the brick work at this point would appear to be 45,294, divided by 184 equals 246 pounds per square inch. See tables 1 and 2 for details.

Now in case the tank had been full, we would have results as follows:—

Assumed Loads With Full Tank.

TABLE NO. 2.

	Pounds.
25,000 gallons of water	207,500
Steel trestle (see Table No. 1)	6,075
12 feet of 8″ pipe, etc. (tank drop) and timber grillage	1,500
Tank	7,600
Total dead load on trestle	222,675
Dead load on each corner (divide by 4)	55,669

In addition to the above dead load there might be a considerable additional weight due to wind pressure.

The events leading up to the fall of the tank were as follows: Trestle work and tank itself had been completed, steam heating coil placed in tank and connected an 8-inch outlet from tank to small fireproof header house, adjoining on south, put in place and connected to tank and even the wrapping and boxing put around this outlet above roof of tower. Owners had started to fill sprinkler tank on Monday, December 4th, and had put about 3 feet of water in tank on that day. It is said that tank did not leak a drop, and each day thereafter about 3 feet of water were added in tank, until by noon of Thursday, December 7th, there was said to have been 13 feet of water in tank, or approximately 20,000 gallons. About 3 feet more would have filled tank to its full capacity, or 25,000 gallons. It is supposed that this 20,000-gallon point had been reached perhaps 2 or 3 hours before tank fell. As nearly as can be learned, up to this time there was no appearance of anything wrong with tank trestle or wall.

At 12.25 p. m., without the slighest warning, tank and trestle fell, carrying with it the greater part of west wall of tower, the wreckage and debris going down through the roof of packing and finishing building adjoining on west, the whole landing as described in the first part of this report. The accident occurring during the noon hour, there was, fortunately, no loss of life. The master mechanic of factory was on his way home to lunch and had reached a point perhaps 1,500 feet from factory when he heard a roar, and looking back he saw a cloud of dust rising from factory and the tank was missing. He ran back and on taking in the situation, he quickly shut the city gate valve leading to sprinkler system, as water from the city at 80 pounds pressure was flowing from the broken sprinkler piping in packing and finishing building and in tower.

Theory of the Accident.

There are various theories as to the cause of this tank falling. One theory is that part of the wall gave way, letting down one side of the trestle and pulling the other legs of the trestle loose from their foundations, the tank then sliding off and going down through roof of packing and finishing building to west, followed by the west wall of brick tower and then by the trestle itself. Another theory is that some of the

steel trestle gave way either by rivets shearing off or by one of the corner posts crumpling and the same result following. Neither of these theories can be verified. The brick wall at top of tower was so badly damaged by the fall of trestle that nothing definite could be determined as to the possibility of wall having given way first.

It was noted that as trestle laid in the wreck, one of the gusset plates was pulled off from the corner posts, shearing off four $\frac{7}{8}$-inch rivets (single shear). It is impossible to say whether this was the cause of the wreck, as these rivets may have failed from impact during the fall of the trestle. From computations these rivets appear to be strong enough to safely carry the stress at this point at time of wreck. Another member of the trestle which was found broken after the fall was one of the horizontal lateral braces between corners of trestle, which had sheared off the two $\frac{3}{4}$-inch rivets which attached it directly to the bottom of the horizontal chord.

As tank trestle was found it presented a very distorted and crumpled appearance. There was scarcely one of the members but that was more or less bent, one or two of the corner posts being bent double and one at right angles. The bottom horizontal chord in north face of trestle, where connecting to gusset plate at northeast post of trestle, was bent upward in a considerable curve, the lower face of the metal being covered with brick dust and dented as though it had struck on a brick wall. The under surface of one or two of the 14″ x 14″ bearing plates presented somewhat the same appearance, and each of these bearing plates was bent upward at a considerable angle at the corner toward inside of tower.

One explanation of the condition of the brick tower walls is that, in falling, the tank slid off toward the west and the heavy trestle then crashed down through roof of tower, the momentum of this mass crushing out west wall as noted. This theory is somewhat borne out by the fact that there are heavy parallel scratches or indentations, 15 inches apart, and in some places 2 inches deep, inside of tower on north and south walls, at a point 14 to 16 feet below top of tower and toward west side. It is supposed these scratches were made by the 15-inch I-beams (19 feet long), which formed top of trestle, in falling through towers.

While none of these theories can be actually verified, two facts stand out very clearly.

First: That the total weight of tank and contents and trestle was carried on four 14″ x 14″ x $\frac{1}{2}$″ bearing plates, thus producing stresses per square inch in the brick work which were far in excess of any safe practice. See descriptions below table No. 1 and table No. 2.

Second: That the design of the steel trestle supporting tank was faulty in that bearing plates were only 14″ x 14″ and that horizontal chords at top and bottom and also diagonal members were riveted to corner posts at points 18 inches above the bottom and below the top of same, which produced a serious bending moment in these posts, which is contrary to good practice. The fact that corner posts were inclined at an angle of over 20 degrees also considerably increased the stresses in the corner posts and all the horizontal members.

Iron Hoops for Wooden Water Tanks

Brief abstract of a committee report presented at the annual meeting of the American Railway Bridge and Building Association.

Flat Hoops. Until recently flat hoops were used almost universally. Many advocate this style as the best, claiming that the hoops have a more uniform bearing on the staves, do not crush the fiber of the wood, and if properly put on and cared for will outlast the staves.

The experience of others has been to the contrary. Flat hoops have been removed after a comparatively short service, badly corroded on the inside and with the staves badly decayed under the hoops. Location of the tank is a factor in the life of a hoop. At a terminal, perhaps next to an engine house or a clinker pit, the hoops will deteriorate rapidly. There are instances in which the water in the tank is especially injurious to the hoops, and location near salt water is also a severe test. In thickness they run from $\frac{1}{4}$-inch to $\frac{3}{8}$-inch and in width from 3 to 6 inches. Some roads use a uniform thickness and vary the width, some use a uniform width and vary the thickness, while others use various widths and thicknesses. Steel hoops are found to be brittle, and often break while being tightened, or as the result of the swelling of the tank or on account of unusual weather conditions. The most serious objection is that they corrode more easily than wrought-iron. Galvanizing lengthens their life, but does not eliminate the brittleness, and many claim that the galvanizing covers surface defects that would otherwise cause the rejection of the material. Galvanized hoops should be inspected before and after galvanizing.

Round Hoops. Round hoops have come into use only within the last few years and seem to be proving very satisfactory. Wrought-iron is considered the best material and is more easily obtained in this form than in the flat shape. Mild steel is sometimes used, but has the objection of brittleness.

One argument in favor of the round hoop is that fully 90% of its surface is exposed to view; deterioration is more easily discovered and painting is more effective. With the flat hoop, at least 40% of its surface is next to the staves and practically inaccessible. It is claimed that because the round hoop has less bearing surface on the stave it crushes into the fiber and not only weakens the stave, but induces decay. Others who have had experience say that if the hoop is properly put on there is no appreciable crushing of the fiber.

The round hoop forms a ledge or pocket on the upper side which allows the accumulation of dirt, cinders and moisture. Some claim that this is not a serious matter because the sun and wind evaporate the moisture before harm can result. The Wheeling & Lake Erie Railway calks the round hoops with oakum and fills the top space with roof cement to shed water and also to protect the hoops.

Square Hoops. The committee received no report from any railway using square hoops as a standard. The Illinois Central Railway has one tank equipped with hoops ¾ by 2 inches, which may be called square hoops for all practical purposes. These have been in service for about twenty years, and show no great sign of deterioration. In parts of Mississippi there are many wooden tanks with hoops from 1⅛ inches to ¾ inches square, put on in three sections.

Segmental Hoops. The segmental hoop has one flat side and does away with the objection to the round hoop of crushing into the wood and of collecting and holding dirt and moisture. It has all the advantages of the flat hoop, with the added one of being narrower for the same length; and because it is heavier at the center it is not weakened so quickly by corrosion. The material is a standard shape that is carried in stock.

In tanks 20 to 30 feet in diameter it is usual to have the hoops in three sections; some railways use four and others use two sections. The two-section hoop is difficult to erect, and by using more sections the stress on the staves can be more uniformly distributed.

The Jamestown Conflagration.

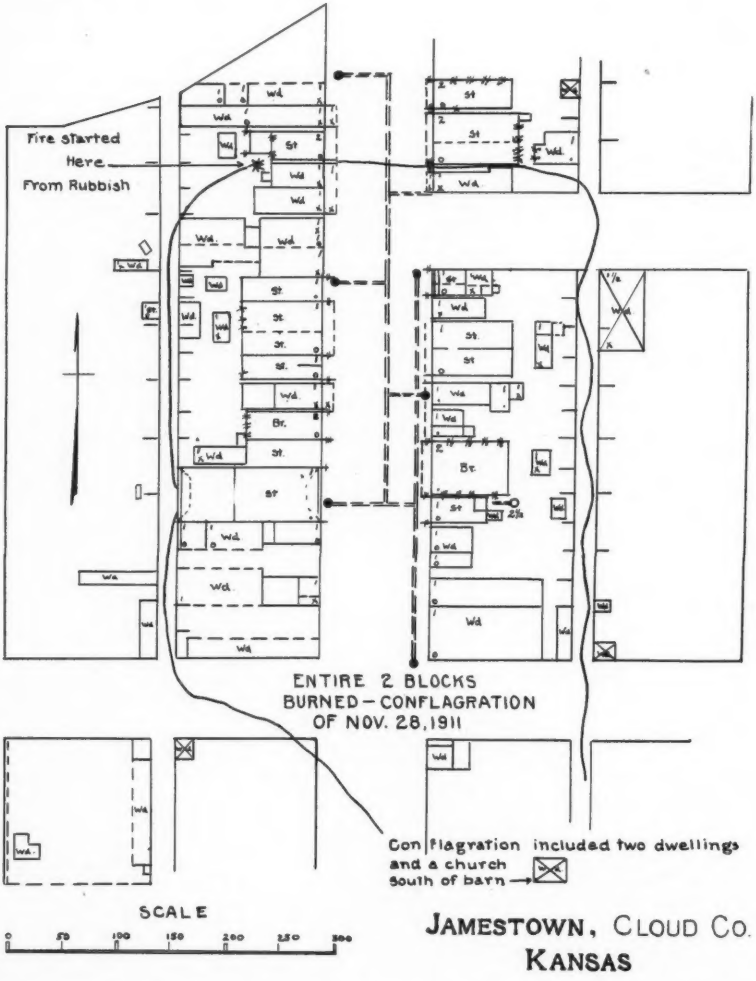
By Charles E. Eldridge (Member N. F. P. A.)

This little burg of some 600 souls suffered a disaster which in proportion to the population was really worse than the Chicago or San Francisco fire. It is typical of fires occurring almost daily somewhere in the United States.

In Block No. 8 some twenty-five stovepipes for flues were present originally, but by educational work along fire prevention lines the number was reduced to five. Unfortunately, if the report be true, the correct criminal stovepipe was not removed. However, in a high wind the draft up a chimney flue is severe, and a stovepipe passing through a wood ceiling and blind attic, and out through a shingle roof can warm up matters pretty generally.

If, however, the other theory is correct, that a locomotive spark and its "affinity" a beautiful blonde rubbish pile, were responsible, still the lesson could be learned for maintenance of properties in clean condition, and ordinances enforced for safeguarding life and the assessor's tax list.

Note the buildings that were wiped out in the one fire. This fire was no respecter of construction, brick or stone walls did not stop the oncoming flames, neither did a 100-foot street, as the heat radiation ignited the


Fire Started Here From Rubbish
ENTIRE 2 BLOCKS BURNED—CONFLAGRATION OF NOV. 28, 1911
Conflagration included two dwellings and a church south of barn
SCALE
0 50 100 150 200 250 300
JAMESTOWN, CLOUD CO. KANSAS

cornices and frame awnings, breaking glass fronts of frame buildings. Evidently, a few fire brands aviated and "did business," as two dwellings and a church at the extreme south of the mercantile area were also included in the loss.

Should not all cities profit by this disastrous experience of the citizens of Jamestown, and eliminate the criminal stovepipe flue; adopt ordinances for the elimination of rubbish accumulations, storage of oils and explosives, and provide an adequate fire protection equipment consisting of efficient waterworks system and fire department commensurate with the needs of the town?

Color, Paint and Varnish Factories.

By F. E. Roberts (Member N. F. P. A.)

PART I.—COLOR FACTORIES.

Historical.

The term "painting" is generally used to denote the fine art of that name. It need hardly be said that the products of the factories covered in this article are used for much more prosaic purposes than that of painting pictures. Still there is no radical difference between the paint for what is known as an oil painting and that for painting a building. The one is of finer materials than the other, but both are of the same nature. So when we look up the history of paints and pigments, we find that their use commenced in a decorative and artistic way. A propensity for the use of pigments and dyes in an artistic way has always been shown by people of ancient civilization, and also by uncivilized tribes as well, the latter, generally in a very crude manner, by decorating the body and articles of ornament or use.

While much might be said concerning the history of painting from an artistic standpoint, only a few facts will be given. Ancient Egyptian paintings on walls of tombs and temples, on papyrus and mummy cases, have been discovered of dates as early as 1900 B. C. Until about 400 B. C. only four colors were known—red, yellow, black and white, the term "color" being used in its ordinary, not in its strict, sense. These pigments, all native in origin, were mixed with gum and water, or a native gummy sap, for use.

While drying oils were possibly known from the beginning of the Christian era, no attention appears to have been paid to them as a medium for mixing with pigments until the discovery of the properties of linseed oil by the monks in the 13th century A. D. It is interesting to observe that their crude formula for its preparation is somewhat similar to the way "hot pressed" oil is made to-day. Oil painting probably commenced about this time, certainly came into vogue in the 15th century A. D. The history of turpentine seems to be wrapped in obscurity, but as it is made from the sap of the pine tree by a simple process of distilla-

tion, it has probably been known for centuries for the purpose of thinning oil paint and hastening the drying.

The manufacture and use of paints for ordinary purposes date from the discovery of an artificial way of making white lead in the 17th century A. D. While a native white lead (lead carbonate) had been known and utilized for centuries, it is probable there was no general use of paints in the ordinary sense until this industry was well established. To Holland belongs the credit of first manufacturing white lead (chemically a mixture of lead carbonate and hydrate). "You cannot beat the Dutch," and it is said that what is practically the old, slow, cumbersome Dutch or "stack" method, as to quality of product, has not been improved on nor indeed equalled by later processes. Presumably the Dutch were the first to manufacture linseed oil commercially, and to make use of it for mixing paint. Some of the first presses used on this side of the Atlantic came from Holland.

The manufacture of white lead is called the foundation of the paint industry, because white lead is the base, or perhaps we should say used to be the base, for most of the common paints in use. If we term white lead the fabric of the paint structure, we must associate with it linseed oil as the binding material.

Introductory.

For convenience, the general term benzine will be used to express any highly volatile product of petroleum that may be employed, as gasolene, naphtha and benzine, or, in some few cases, volatile products of coal tar, as coal tar naphtha and benzol. Reference is made to the record of paint, color, and varnish factory fires, published in the October, 1908, issue (Vol. 2, No. 2) of the QUARTERLY of the National Fire Protection Association. It was assumed, and it is true of most establishments, that linseed oil, substitutes therefor, turpentine, products of petroleum or coal tar, alcohol, white lead and many other pigments, are purchased, and not manufactured on the premises. The manufacture of various coloring pigments and paint products, of varnishes and japans, will be considered parts of a complete plant.

Pigments.

The pigments procured, ready for use, comprise all the whites and blacks, the usual browns, and some yellow, red and blue pigments. Many are natural mineral products, more or less purified, others prepared by processes beyond the scope of ordinary dry color works. The principal varieties are as follows:—

White Pigments. White lead, zinc oxide (zinc white, Chinese white), lead sulphate (sublimed white lead), barium sulphate (barytes), blanc fixe (an artificially prepared form of above), lithopone (a mixture of zinc sulphide, zinc oxide and barium sulphate), calcium carbonate (whiting, Paris white), calcium sulphate (gypsum, terra alba, mineral white), kaolin (China clay).

Black Pigments. Lampblack, boneblack, carbon black.

Brown Pigments. Umber (raw and burnt), Vandyke brown.

Yellow Pigments. Ochre, Sienna, litharge (lead oxide).

Red and Orange Pigments. Iron oxides (Venetian red, Indian red, colcothar), red lead, orange mineral. The two last are considered chemically as mixtures of lead oxide and peroxide.

Blue Pigments. Ultramarine, cobalt blue (artificial mineral pigments).

The white pigments mentioned, other than white lead, may be used as substitutes for that material, either in whole or in part, in making up the base for paints.

Hazards. With the exception of the blacks, all of the above pigments are generally considered as non-hazardous in storage. Still, in some cases, there are a few which will be mentioned that might make trouble.

Laboratory

Zinc Oxide. A barrel of zinc oxide, on being opened, was found to be a glowing mass in center of barrel. Zinc oxide is manufactured by burning the vapor of zinc in a current of air. If air supply was insufficient, some zinc might fail to burn and be deposited in a finely divided form with the zinc oxide. In this form zinc is liable to spontaneous combustion, especially with access of dampness, possibly aided by pressure. It would seem that a considerable deposition of zinc dust at one point in the barrel would have to occur for this to take place, and further, that while the zinc oxide in immediate contact might be heated to incandescence, such incandescence would not extend far. Zinc oxide itself is incombustible. A possible, but not a probable, hazard.

Vandyke Brown. The natural mineral product probably is harmless, but as some so-called Vandyke browns, artificially made, contain lampblack, such product might be subject in modified degree to lampblack dangers. Trouble with this color is probably rare.

Black Pigments. If material is free from oil, not too closely packed, and is preserved from dampness or excessive heat, cases of spontaneous ignition will be rare. By excessive heat is meant, for instance, setting a barrel of lampblack against hot steam pipes. In one establishment, at least, care is taken that the barrels shall not be roughly handled, tending to compact the mass. Storage is generally not large. It is bulk storage in barrels or larger containers where trouble, if any, may arise. Storage in the familiar paper packages ordinarily presents no danger.

Dry Color Works.

Manufacture of Pigments. The usual process of manufacturing pigments, or what are generally known as "dry colors," is purely a chemical one, that of precipitation. From a fire point of view it has the advantage of being a "wet process." The principle of chemical precipitation as applied to dry colors is as follows: When two or more substances are dissolved in water or other liquid, mixed together, and a product can be formed by mutual decomposition of ingredients, at the existing temperature, that is insoluble in the liquid medium used, or that may be formed, such substance will separate in the solid state called a precipitate. This is in the form of a powder or sediment. Thus when a solution of potassium chromate in water is mixed with a similar solution of lead acetate, lead chromate (chrome yellow) separates as a precipitate, while potassium acetate remains dissolved in water used. The chromic acid leaves the potassium and unites with the lead to form lead chromate, at the same instant the acetic acid leaves the lead and unites with the potassium to form potassium acetate. It must not be supposed that all the reactions used in color making are as simple as this,—indeed this is not quite the way chrome yellow is commercially prepared,—but the principle is the same. Some of the solutions are quite complex, various acids are added, different degrees of temperature are employed (not exceeding boiling point of water), but it is steam heat that is utilized, and always water in excess.

It is a well-known principle that from the three primary colors, red, blue and yellow, all the hues of the rainbow can be made by appropriate mixing. These colors (possibly in several shades) are prepared by the precipitation process mentioned. Green is also prepared by precipitating a yellow on a blue pigment in the vat. The four pigments, red, blue, yellow and green are the dry colors usually manufactured for use in the paint factory. Any further combinations necessary to produce different tints are made when the colors are ground in oil, or in the final mixing of the paint. The pure pigments generally possess great coloring power, and an addition of considerable, much cheaper, white pigment can be

made without materially altering the tint. Such admixture is made in the precipitating vat. This allows the manufacturer to prepare several grades of the same color at corresponding prices. Either C. P. (chemically pure) or the so-called "graded" or "extended" colors are used in making paint.

"Lake" pigments, using coal tar dyes, may be manufactured for use in paints. Technically a "lake" is a metallic salt of an organic color acid. A popular description of such a pigment might be "a chemical combination of an organic with a metallic substance." The process is essentially the same as described when a color is liberally extended with

Color Vats

an admixture of white pigment. In a vermilionette, or eosin red, such "base" may consist in whole or in part of orange mineral. The precipitated particles of pure pigment, intimately mixed with the particles of base contained in the vat, have sufficient coloring power to give the effect of one solid color. "Vermilionettes" using a coal tar dye of the eosin class, and "permanent reds" using dyes of a different class in a somewhat complicated reaction, are the usual representatives of these pigments for paints. Any color, however, can and may be made and vegetable dyes can be used in place of coal tar dyes. Lake pigments have had the reputation, with some reason, of being liable to fade, hence the name, "permanent red" said to be deserved. Many are combustible.

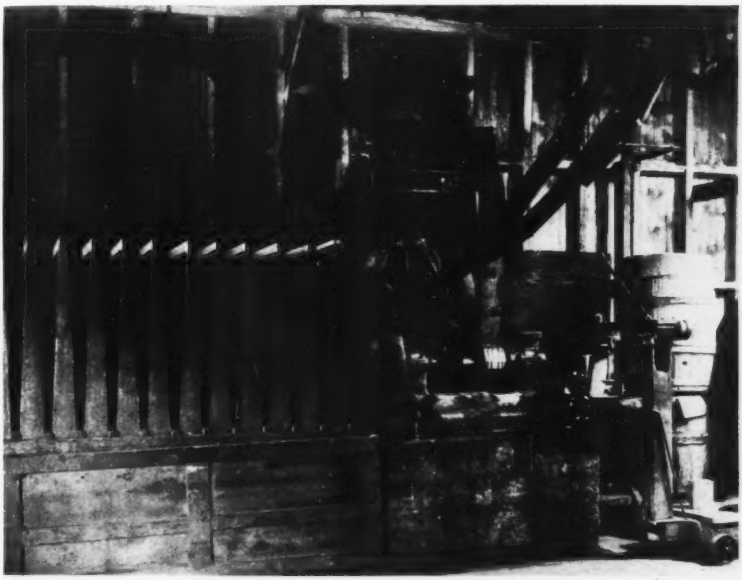
Wooden vats are employed for the precipitation (one size is 8 feet diameter, 7 feet high) provided with power mixers (vertical shaft fitted with horizontal arms or paddles). Five hundred to 4,000 pounds of pigment are made at a time in vat of above size, according to whether chemically pure or a graded color is being prepared. When the precipitation of color is complete and the precipitate has settled to the bottom of the vat, the supernatant liquid is drawn off to the sewer, and the sediment of color thoroughly stirred up and washed with several changes of water, one test being that the final washing water shall not turn blue litmus paper red (absence of free acids). By an old cumbersome method (yet in use), the color is allowed to drain over cloth, the wet mass gathered in cloths into flat cakes, and water expressed by a hand lever or screw press. The modern way, however, is to pump the sludge of color through a filter press, which collects the sediment in the upright shallow chambers, covered with filter cloth, composing it, and effectually removes most of the water, leaving coherent cakes of color about 14 inches square and 1¼ inches thick.

Drying. The cakes of color, whole or broken into small pieces, are placed on slatted wood frames, covered with paper or cloth, and piled one above the other on floor of drier. Or there may be fixed or movable wooden or metal racks in drier. Dry rooms or closets are generally of wood and usually metal lined, heated by steam pipes or hot air blast, preferably the former, in which case circulation of air may be induced by an exhaust fan on the same principle as utilized in a laundry drier. Heat 120° to 140° F. Time of drying from two days to a week.

Grinding. While there are various forms of mill for grinding colors, only three will be described, which may perhaps be considered as general types.

Pulverizers are a combination of beating and cutting or rashing. A popular kind is the Schutz-O'Neil Limited Pulverizer. The pigment first passes through a "disintegrator" (not a part of the mill but connected with it). This is an arrangement of interlocking teeth with wide clearance which breaks up the large lumps. The material then falls into the feed hopper of the pulverizer. The grinding is done by a beating process against the sharp corrugations of a fixed shell lining the inside circular surface of a grinding chamber, this chamber being in a vertical position. The beater plates consist of steel discs, around the edge of which are riveted projecting steel lugs or beaters, there being from two to five beater plates, according to size of mill. The plates are fastened on a horizontal shaft extending through the center of chamber and revolve very rapidly within the corrugated lining, the direction of the corrugations being at right angles to motion of discs. The speed of a 28″ mill, 1,800 revolutions per minute, and for a 14″ mill, 3,200 revolutions. Clearance between beaters and corrugated shell is about ¼ inch. The inside beater plate has several perforations to let air into chamber, and also two fan blades to force current through mill. There is also a perforated "mill plate" for keeping material in chamber not perfectly ground, and

a cone plate adjusted to fit more or less closely the cone shaped delivery, which regulates quantity of air passing through mill and fineness of product. Both of these plates are fixed on shaft and revolve with it. A fan contrivance returns the "tailings" (coarse pieces) through the mill again. As the product is blown into the receiver more or less in the form of dust, it is necessary to have such receiver covered with a cloth dust collector, which allows air to pass out and retains material. This is a very efficient form of mill, not exactly free from fire hazard if a nail or pebble happens to get mixed up with the color.



Schutz-O'Neil Pulverizer and Receiver

The attrition mill is simply an adaptation of the ordinary stone grinding mill, the buhr stones being placed vertically inside a mill case. They can be adjusted to run more or less closely according to fineness of product desired—speed about 600 to 700 revolutions per minute. The pigment is first passed through a "disintegrator" as in the pulverizer.

A ball mill is an iron or wooden cylinder about 36″ in diameter, 30″ long, resting in a horizontal position on trunnions. Opening in side is closed by a perforated iron plate which can be replaced by one without perforations for fine grinding. The top half of cylinder is enclosed by movable metal cover, lower half by a wooden casing, which latter receives product. The cylinder revolves on its horizontal axis at a speed of about 45 revolu-

tions per minute. Grinding is done by a number of iron balls from 1″ to 3″ in diameter, placed in cylinder with material to be ground.

Hazards. The hazards of heat, light and power need no special mention, except that electric lighting is advisable for grinding section, the installation for this, and also for power, if electric, to be standard for dusty places.

There are no special hazards up to the drying and grinding operations except the storage and use of chemicals, which is very moderate, where carelessness does not form a factor. Principal chemicals used are

Ball Mills

as follows, the chemical name being given when the trade or common name serves to conceal, rather than to reveal, the identity of the substance: bichromate of potash or soda, prussiate of potash (potassium ferrocyanide), sugar of lead (lead acetate), copperas (sulphate of iron or ferrous sulphate), nitrate of lead, bleaching powder or chloride of lime, carbonate of soda, caustic soda, Glauber's salt (sodium sulphate), nitrate of soda, acetate of soda, alum, oxalic acid (a solid), orange mineral and various white pigments and coal tar dyes; sulphonic acid, acetic acid, sulphuric, muriatic and nitric acids.

At least a carboy each (10 gallons) of the three strong acids mentioned last will be stored, and it is advisable to keep these acids away from

the other chemicals. If this is done there should be no trouble. The special hazard of sulphuric and muriatic acids, when not mixed promiscuously with other chemicals by breakage or carelessness, is that of noxious fumes in a fire arising from other causes; of nitric acid the same in a much higher degree, also, if strong enough, of starting a fire in connection with packing material or rubbish. It may be remarked that the only packing material necessary is that contained in the crates containing carboys of acid, and there is no necessity at all for rubbish. The danger of spontaneous combustion from the chemicals carried is remote and could only occur by extreme carelessness and inattention to ordinary cleanliness.

Chlorate of potash is sometimes used for oxidizing one color as first precipitated—Prussian blue. This is a dangerous chemical in handling and storage—there is no danger in the process of oxidizing the wet color. If used at all it is only in small quantities that can be brought in from outside as required. The dangers of handling and storage of this substance are well known.

The operations of drying and grinding are the principal hazards of color manufacture. The record of the National Fire Protection Association shows that all the fires reported from dry color works, nine in number, occurred in drying and grinding.

Hazards of Drying. It is needless to enlarge on the fact, often brought to mind, that fires occur in driers in which the substances dried bear no part. The record referred to gives six fires from drying colors, in three of which colors ignited. The others were due to the ordinary hazards of a drier, more or less combustible in itself, and with combustible contents outside of material dried, the colors not being the cause of ignition. It is not intended to convey the idea that colors are very combustible. Some are at least very difficult to ignite, some more or less easily ignited by a flame. The common color, Prussian blue, is an example of the latter class. It burns with a glimmering combustion, perhaps difficult to follow, but which will penetrate the whole mass and is not easily extinguished. But probably no color, so long as it preserves its integrity, will inflame quite so easily as the paper or cloth, possibly wood, always present.

Apparently the trouble with some colors is that occasionally chemical action sets in, the compound decomposes, and what may in a sense be called spontaneous combustion ensues. From the fact that for a long period the operation of drying a certain color causes no ignition, when suddenly fire takes place, one of two theories may be advanced. First, that a sudden and considerable increase of the usual temperature of drier occurs, which is considered sufficient to start chemical action; or secondly, that the color which inflames is not the identical one that has formerly given no trouble. It is not meant to insinuate that an experimental modification is under trial, but simply that the color may contain some impurity which, under the ordinary heat of drying, can incite chemical action in a substance that would otherwise remain quiescent.

It appears possible that imperfect washing of the color might result in such impurity. In some portion of the batch, chemicals used in the process, or that are formed, might remain in the precipitate and prove the necessary incentive to chemical action, especially acids. Again, trade chemicals are not always chemically pure, and therefore products not contemplated are introduced or formed. The barytes admixture, if made, would not favor chemical action; in fact it should be considered a retardant. Whether the above is the true reason or not, the evidence seems to point to the fact that ignition is due to a peculiar condition of the color, rather than to overheating.

It is interesting to observe, that in two out of three cases in which colors ignited, the common color Brunswick green, or chrome green, was in fault. This is a mixture, not a definite chemical compound, of Prussian blue and chrome yellow, often with a large admixture of barytes; or, as pointed out by others, a mixture of a combustible substance with an oxygen carrier, the barytes being incombustible and acting as a retardant to chemical action, if at all. But this does not explain why chemical action and therefore combustion should take place at 140°. This green is made in large quantities both in the United States and Canada with only few cases of ignition, and not with constant trouble.

Hazards of Grinding. The hazard of grinding may be the familiar one of spark struck by foreign substance, but not necessarily so. For instance, it is probable that chrome green can be ignited without any spark. A chemically pure green, under the friction of grinding in the confined space of the mill chamber, apparently will not stand any considerable increase of temperature, probably not so high a degree as it has undergone in the drier, when in the form of broken cakes. If no attention were paid to a considerable rise in temperature, which did not lead to chemical action and fire in grinding, the hot product, packed directly in a barrel, might decompose and fire occur. From the method of preparation it may be inferred the danger of accidental foreign substances is less than in many other substances ground.

In the three fires from grinding, it may be noted that Brunswick or chrome green is responsible for two, to which can be added a Canadian fire not covered by report. This last fire illustrates the fact that while chemical action may be started in a drier, it may not reach the point of ignition, also that a change of tint indicates that such action has commenced. This change was noted by the chemist, instructions given not to attempt grinding, which were disobeyed, with the result of an explosion and fire. In this case a ball mill was used for grinding. A "graded" or "extended" color, containing a large amount of barytes or other incombustible white pigment, has given no trouble, so far as records show, but possibly might do so if spark were struck in grinding. Such colors are certainly less hazardous in drying and grinding than chemically pure colors.

It may be conceded that the hazards of drying and grinding colors are not acute, yet they are *the* hazards of color manufacture. Moreover,

the art cannot be expected to stand still, and if danger exists in any new color brought out, it will be almost certain to show itself sooner or later in the drying or grinding, not in the making. From a fire point of view the drying and grinding processes should be isolated from the preparation of colors; and such separation has been proved satisfactory from a business standpoint.

Recommendations.

Construction, Color Making Department. Where this is a department of a paint factory, it may be desirable for it to form an adjoining section, and will naturally follow the method of construction adopted for that building, which should be first class. To be cut off by solid fire wall with no communication, to be a 2 or 1 = 2 story building with no basement, and grade floor cement. In the latter case it will be necessary to have a gallery floor, the vats extending through this floor. The operations connected with dry color preparation and paint making are entirely distinct. There is absolutely no reason connected with the business why there should be any communication. It is advisable to guard against easy introduction of paint factory hazards by careless workmen, or otherwise; moreover, as a fire is much more likely to occur in the paint factory than in preparation of colors, a solid fire wall is a better protection than one with fire door.

Construction, Drying and Grinding Department. Should be cut off, or better, detached 15 feet. If covered passage connects, fire door to be placed at entrance if first class construction, otherwise at entrance of color preparation. To be at least metal-clad with first class roof, but preferably of brick or fire resistive construction. In either case this should be but one story with no basement, and cement floor. Even with metal-clad construction it would be advisable to divide into two sections by fire wall of brick or concrete, with fire door communication. The drying room will occupy the greater portion of one section. This room, if frame construction, should have standard metal protected walls and ceiling, metal for ceiling to follow contour of rafters; or by cement on expanded metal with an approved incombustible flat ceiling. Self-closing, metal-clad door in either case. With first class construction it will be easy to make the room practically fireproof and install a standard fire door. It would certainly be an advantage to give the grinding section some fire resistive qualities, as well as the drying, though not so essential.

Process. There are no recommendations imperative for color preparation except to wash colors thoroughly, and keep the strong acids away from the other chemicals. Heating of dry room should be by steam pipes carefully installed at sides. This is preferable to hot air blast. Induced current of air if desired may be supplied to steam coils by fan located in grinding room, venting through roof. Metal racks are desirable for drying, as paper or cloth for support of colors cannot be dispensed with. Racks should be placed clear of steam pipes, so that no colors can drop onto them.

In grinding especial care should be taken as to presence of any foreign material and watchfulness exercised as to any signs of "breaking down" or decomposition, either before or after grinding. A chemically pure chrome green needs careful attention, and any sudden rise in temperature is a signal of danger that should not be disregarded. Even if the color goes safely through the mill, if it is packed immediately in an unusually hot condition, trouble may arise later. Any color that consists of a combustible material and an oxygen carrier as this green (Prussian blue and chrome yellow), should be ground with care. Orange mineral used in vermilionettes is an oxygen carrier as well as chrome yellow. While I have no personal knowledge of trouble with Prussian blue alone, I believe care should be exercised in grinding, or in fact of any color containing this substance, which is combustible and not very stable from a chemical point of view.

Fire Protection. Standpipe and hose, fire pails, and chemical extinguishers should be installed. If steam is available at not less than sixty pounds pressure, steam jet in dry room is advisable. Sprinkler protection will be efficient and should include dry rooms.

Storage of Dry Colors. Where a dry color department is run in connection with a paint factory, the principal storage will generally be found in the latter building, and something will be said regarding any hazards of such storage in a subsequent article under the heading of "Paint Factories." Certainly there should be no great amount of storage in grinding section and a separate building or cut-off section for bulk of storage of dry colors would be an advantage both to dry color works and paint factory.

Department of Fire Record

J. ALBERT ROBINSON, Superintendent.

The Brewery Fire Record.

There are very few breweries in the country that have been equipped with an automatic sprinkler system. This has probably been due to the fact that the average brewery is of superior construction. In the few cases, however, that we have on record, where fires occurred in sprinklered breweries, the action of the sprinklers has been eminently satisfactory and amply demonstrated the desirability of such an equipment.

The record of losses in brewery fires seems to indicate that, as a class, the prevailing type of construction and the nature of hazards were such as to result in much lower losses than usually prevail in classes that are largely unsprinklered. In 42 per cent of the cases the loss was small or negligible, and in 28.5 per cent the loss was moderate. In 14 per cent of the cases there was a large or total loss. In some statistics gathered on brewery fire losses during a ten-year period, it was shown that the average loss per fire was 7 per cent of the total value.

The greatest number of fires was due to common causes, these amounting to 39 per cent of all fires. The principal causes were lighting, smoking, locomotive sparks and careless workmen.

Special hazards caused 28 per cent of all fires. Barrel pitching caused 39 per cent of these, malt grinding 25 per cent and malt drying 11 per cent.

From a study of the fires of a special hazard origin, the following facts have been deduced:—

Fires in pitching rooms, if built of wood, are apt to be flash fires due to the fact that woodwork in room has become saturated with pitch from pitch-laden vapors that constantly arise in the process of pitching kegs. Pitch kettles should not be left alone when in use. Pitching sheds are frequently ignited by overflowing of pitch, or the ignition of vapors. Pitch kettles are generally of iron set over coal-fired brick super-heaters. Steam heat, instead of direct heat, in pitching rooms would reduce the

hazard. Pitching rooms should be of fire-resistive construction, cut off or detached from cooper shop or other buildings.

In malt houses the principal danger is not from the malt kilns, but from ventilating fans, the rapidly revolving fans causing overheated journals. Ventilating fans should be housed in fire-resistive rooms.

The Hooker system of grain drying used in a number of breweries consists of a high steel tower about eight stories in height, through which hot air is drawn from boiler flues by a blower, and down which the wet grain is allowed to circulate after being elevated to the top of the tower by two ordinary chain and bucket elevators in steel and wood-enclosed shafts. Grain dryers should be put in a cut-off building and have as little woodwork about them as possible. Attendants should never leave dryers alone.

Malt used at some breweries is screened before being brought to plant and also again screened at plant before being ground. Some screens are equipped with magnets and some are not. Where the screening machines are not equipped with magnets, probably more steel and iron chips, etc., pass over the grinding mill magnets than would if the screening machine were also equipped with magnets.

Malt mills should preferably be made of iron and have iron relief covers. Ducts and elevator legs should be of iron. Hoppers on malt mills, which are made of wood, are readily blown out in case of explosion. Magnets should be carefully watched and replaced when they begin to show any weakness. Dust arresters are important adjuncts to malt mills. Explosions in these mills are liable to create sufficient back draft to carry burning dust to ducts and head of elevator legs and thence by conveyor to ground malt bins. Fires frequently break out due to explosions in malt mills in the vicinity of bins on the upper floors.

Breweries—Fire Record

Total Number of Fires, 100.

1. CLASSIFICATION OF CAUSES.

Summary.

Common Causes.

	No. of Fires.	Per Cent of Common.	Per Cent of Whole.
Lighting	6	15	6
Power	2	5	2
Boiler	3	8	3
Spontaneous Ignition	4	10	4
Smoking	5	13	5
Matches	1	3	1
Locomotive Sparks	6	15	6
Lightning	1	3	1
Fourth of July	1	3	1
Careless Workmen	6	15	6
Mischievous Children	2	5	2
Sparks	2	5	2
Total	39	100	39

Special Hazard Causes.

	No. of Fires.	Per Cent of Special.	Per Cent of Whole.
Barrel Pitching	11	39	11
Malt Grinding	7	25	7
Malt Drying	3	11	3
Grain Drying	2	7	2
Spontaneous Ignition in Ice House	2	7	2
Cold Storage	1	3.5	1
Vat Varnishing	1	3.5	1
Elevator Leg Friction	1	3.5	1
Total	28	99.5	28

Common Causes	39		39
Special Hazard Causes	28		28
Exposure	3		3
Incendiary	2		2
Unknown	28		28
Total	100		100

Details.

Common Hazards.

64. Careless Workmen. Workmen engaged in making repairs to elevator started fire with gasolene soldering torch.

66. Careless Workmen. Men were thawing out frozen pipes at water tanks by using lighted candles. A candle was allowed to burn away, setting fire to a rafter.

67. Light. Gas which had leaked and accumulated in basement ignited by ice puller's candle.

384. Matches. Proprietor lighted match to look at cash register. Spark flew into gauze trimmings of bar.

1063. Locomotive Sparks. Started in wall of artificial-ice building.

1223. Fourth of July Fire. Sky rocket supposed to have fallen in malt through open window.

1287. Careless Workmen. Fire started in wheel pit of engine, while several men were about.

1307. Light. Lighted candle left in storeroom by employee.

1409. Boiler. Frame partition too near brick setting of a boiler recently installed.

1574. Light. Short circuit in electric wiring near roof.

1579. Spontaneous Ignition. Painters' rags left by men who had been varnishing office.

1784. Locomotive Sparks. Occurred on roof of germinating room.

1933. Locomotive Sparks. Entered ventilator and ignited hay in barn.

2087. Careless Workmen. Painters disarranged electric light wires on roof.

2197. Mischievous Children.

2372. Smoking. Match or cigar stub thrown in opening on floor of saloon.

2417. Smoking. Hot pipe or matches left in workman's clothes in locker.

2549. Boiler. Night man was cleaning out boiler oil feed pump and the vapor from oil was exploded by coming in contact with his lantern.

2771. Careless Workmen. Caused by plumbers repairing pipes.

2986. Sparks from Boiler Stack.

3006. Power. Friction of belt.

3031. Spontaneous Ignition. Occurred in pile of empty malt bags.

3061-A. Sparks from Boiler Stack.

3084. Smoking. Watchman was smoking and set fire to hay on second floor of stable.

3293. Light. Heat from electric bulb attached to long portable lamp cord ignited pile of burlap bags, on which it was carelessly laid.

4193. Spontaneous Ignition. Occurred inside of a grain cleaner which had been idle for about two months.

4682. Light. Poor electric wiring.

4915. Light. Worn or defective electric wiring.

5434. Mischievous Children. Fire caused by children having a bonfire in alley.

6261. Smoking. Hot pipe or matches in pocket of workman's coat which was hung too close to hot steam coils.

6267. Boiler. Fireman carelessly laid red hot slice bar against woodwork.

6601. Power. Short circuit in electric motor.

6613. Careless Workmen. Employee repairing tin-work on tower left his blowtorch burning when he went to dinner.

6778. Lightning. Did not penetrate building.

9269. Locomotive Sparks. Spark entered wooden sheathed roof house on malt house containing coils, through cold air intake.

Special Hazards.

388. Barrel Pitching. The supply to the natural gas heated pitching kettle was turned off and vapor from pitch was thought to have been ignited by contact with hot stack in which soot was smouldering.

552. Malt Drying. Occurred in kiln while in operation.

868. Malt Grinding. Foreign material in malt mill caused a spark which passed through ground malt elevator legs to malt bin on top floor of brew house.

906. Malt Grinding. Explosion occurred in malt mill.

1096. Barrel Pitching. Smoke pipe from pitching machine came in contact with the wooden cornice.

1192. Cold Storage. Fire occurred inside of wooden boxing around six-inch brine pipe from refrigerating machine which was filled with pitch and ground cork; undoubtedly caused by development of heat in the pitch compound which was poured in four hours previous to the discovery of the fire.

64-A. Elevating. Friction in elevator leg in malt house.

1379. Spontaneous Ignition. Occurred in wet sawdust and shavings in ice house. Broke out three times during the day, the third time proving disastrous.

1468. Barrel Pitching. Pitching kettle was left unattended, and a draft blew fire against the side of pitching shed or into the kettle.

1550. Spontaneous Ignition. Occurred in shavings and sawdust packed at sides of building which was formerly used as ice house. Had been on fire in practically the same place twice the same day.

2192. Malt Grinding. Explosion occurred in malt mill. Fire communicated through from elevator legs to malt bin, to which it was confined.

2383. Malt Grinding. Spark occurred in malt mill.

2442. Barrel Pitching. Pitching kettle was overcharged and boiled over during absence of the attendant.

2745. Grain Drying. Dryer had just been emptied of dry charge and new wet charge had been put in. Apparently the new wet charge did not move along properly and part of the apparatus became overheated, causing the fire.

3202. Malt Grinding. Foreign material passing through malt mill caused explosion, although mill was provided with good magnets and explosion preventor. Explosion occurred in dust in the elevator legs.

3637. Barrel Pitching. Pitching kettle was poorly arranged. Pitch ran over and was ignited from coal fire. There was considerable combustible material near kettle.

3881. Grain Drying. Fire apparently occurred from spontaneous ignition or from the heating of the grain on the screens over the kilns.

4573. Barrel Pitching. Fire caused by man who was lighting fire to heat pitch.

5775. Vat Varnishing. Vats had just been varnished with brewer's pitch. The varnish vapors were ignited by torch carried by someone passing by, which caused an explosion in one of the vats.

5997. Barrel Pitching. Ignition of varnish while coating barrels.

6181. Malt Drying. Fire occurred in fireproof malt dry kilns while kilns were full of malt.

6458. Barrel Pitching. Pitch kettle became overheated, or boiled over, setting fire to belting overhead and also frame shed in which it was located.

6614. Malt Grinding. Foreign substance passing through a Dobbler mill caused spark. An explosion occurred which opened the relief cover.

6616. Barrel Pitching. Violent explosion occurred in a Universal Pitching Machine from unknown cause.

6670. Malt Grinding. Explosion of dust occurred in a dust arrester of malt mill.

6809. Malt Grinding. Foreign material passing through malt mill caused a spark which was carried to receiving hopper under cover of another malt mill, which allowed it to smoulder but not break out. When spark reached hopper it exploded dust which had accumulated there.

7151. Barrel Pitching. Pitch kettle boiled over into coal fire and frame pitching shed was set on fire.

7033. Barrel Pitching. Pitch was ignited by fire in furnace and was communicated to pitch-saturated woodwork of building with such rapidity as to resemble an explosion.

Exposure.

716. Fire caught from a wholesale grocery exposure.

4605. Fire caused by spark from roof of germinating room from fire in coal pockets south of plant.

6630. Burning brands from a one-story frame building adjacent.

Incendiary.

648. Baled hay was carried into building and a fire set.

3323. On entering the building shortly after fire was discovered, two water pails, each nearly filled with a highly inflammable material used for the purpose of painting structural iron work, with a lighted candle inserted in each pail, were found on the second floor in a room which was occupied as a sleeping apartment by one of the owners.

Unknown.

50. Fire discovered breaking through roof over loft in wash room. Loft used for keg storage, etc.

274. Occurred on fourth floor occupied for storage of ground malt, water tanks and surface coolers.

607. Occurred in frame barn.

1115. Possibly due to incendiarism or cigarette used by watchman. Occurred in malt mill section.

1552. Occurred in wash house.

1617. Occurred in basement of bottling department near a carpenter's bench.

1744. Discovered between two bins of ground rye and malt.

2117. Occurred in work room.

2179. Pitching machine had been raised from foundation and left suspended by chains. Fire occurred on top of the suspended machine which had a coating of pitch, and spread to barrels piled nearby. Incendiarism was suggested.

2629. Occurred in cooper shop. Was possibly caused by painters' cloths or rags left on steam pipes in room.

2820. Occurred in brewer's office, second floor.

2846. Occurred in engine room.

3061. Fire started in a corner of room above boiler. It was suggested that it might have been due to a match being thrown in a corner. Smoking was not allowed, however.

3846. Workmen had been at work the day previous laying a waterproof material on the floor. It was thought that this possibly might have been the cause of fire.

4243. Occurred in boiler room.

4394. Occurred in bottling house.

4761. Premises vacant during holiday. Fire occurred in bottle storage department.

4785. Supposed to have occurred from short circuit of electric wires or spontaneous ignition of accumulated oily waste material between floor and ceiling of pump and condenser rooms.

5008. Occurred in brew house.

5086. Fire occurred among corks in storage house.

5089. It was thought that fire was possibly caused by careless smoking, although smoking was strictly forbidden about the premises.

5634. Occurred at fan house above malt kilns.

5637. Occurred on conveying floor of malt house.

6047. Occurred in small tank room on top racking room in wash house, due possibly to combustible material and candle left burning in room, or an employee stealing a smoke.

6472. Occurred in angle outside of building next to wash room. A pitch kettle was located nearby but had not been used for three days. Fire occurred at noon time.

6997. Fire occurred in boiler house.

Watchmen's Failures.

Watchman failed to discover fire in six cases, or twenty per cent of the fires where watchman's service was maintained. Fire was discovered in two cases by employee, and in four cases by an outsider, where the watchman failed in his duty. Details as follows:—

3323. Fire discovered by outsiders. This was a clear case of incendiarism. Watchman's service was standard. Watchman was not accused of the crime, but his whereabouts were not explained in the report.

6997. The alarm was given late, as the watchman was asleep and failed to give alarm until some time after fire had started. An outsider pulled in public fire alarm box.

3881. Failed to discover fire, as he was in a different part of building. Discovered by employees.

1552. Fire was discovered by an employee, who notified the watchman. The latter had failed to discover fire.

2846. Fire discovered by outsider. Details of watchman's failure not given.

3084. Watchman failed to discover fire, being in another room. Was discovered by an outsider who, after considerable delay, sent in an alarm from a street box.

2. MISCELLANEOUS STATISTICS.

Statistics on Losses.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
No Claim	3	8	2	7	..	..	5	5.5
Slight Loss	4	11	4	15	1	3.5	9	10.
Small Loss	10	28	9	33.5	5	17.5	24	26.5
Moderate Loss	9	25	9	33.5	8	29	26	28.5
Considerable Loss	2	6	3	11	9	32	14	15.5
Large Loss	5	14	..	..	1	3.5	6	6.5
Total Loss	3	8	..	..	4	14.5	7	7.5
Total with data given	36	100	27	100	28	100	91	100
No data	3		1		5		9	
Total	39		28		33		100	

Protection Used.

The following kinds of protection were mentioned: chemical extinguishers used in six cases; standpipes used in nine cases; water pails used in eleven cases; private outside equipment used in seventeen cases; public outside equipment mentioned in sixty-five cases. In eighteen cases no mention was made concerning the nature of equipment used. In one case the report stated that the fire was allowed to burn itself out.

Automatic sprinklers practically extinguished three fires, and fire was extinguished before sprinklers operated in one other case.

3. ROOMS IN WHICH FIRE OCCURRED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Barn or Stable	2	5.5	..	..	2	7	4	4.3
Barroom	2	5.5	..	..	..	..	2	2.2
Barrel Pitching Department	..	..	11	39	..	..	11	11.7
Boiler House	4	11	..	..	2	7	6	6.4
Bottling Department	3	8	..	..	1	3.5	4	4.3
Brew House	2	5.5	4	14	2	7	8	8.6
Cold Storage (Mechanical or Ice)	2	5.5	1	4	1	3.5	4	4.3
Condenser Room	..	..	..	..	1	3.5	1	1.1
Cooper Shop	..	..	..	..	2	7	2	2.2
Engine Room	1	2.5	..	..	1	3.5	2	2.2
Ice House	2	5.5	2	7	..	..	4	4.3
Locker Room	1	2.5	..	..	..	..	1	1.1
Malt or Grain House	5	13.5	9	32	3	11	17	18
Office	1	2.5	..	..	1	3.5	2	2.2
Outside	..	..	..	..	2	7	2	2.2
Paint Shop	2	5.5	..	..	..	..	2	2.2
Roofs	2	5 5	..	..	1	3.5	3	3.3
Storage Miscellaneous	6	16.5	..	..	5	18	11	11.7
Top Floor	1	2.5	..	..	2	7	3	3.3
Vat Room	..	..	1	4	..	..	1	1.1
Wash House	1	2.5	..	..	2	7	3	3.3
Total with data given	37	100	28	100	28	99	93	100
No Data	2	..	..	..	5	..	7	..
Totals	39		28		33		100	

4. DAY OR NIGHT FIRES. (Day Fires 6 a. m. to 6 p. m.)

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Day	16	47	18	66	10	33	44	48
Night	18	53	9	34	21	67	48	52
Total with data given	34	..	27	..	31	..	92	..
No data	5	..	1	..	2	..	8	..
Total	39		28		33		100	

5. PLANT IN OPERATION.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Plant in operation	15	52	18	69	13	42	46	54
Plant not in operation	14	48	8	31	18	58	40	46
Total with data given	29	..	26	..	31	..	86	..
No data	10	..	2	..	2	..	14	..
Total	39		28		33		100	

6. HOW DISCOVERED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Employee	18	51	19	76	9	28	46	50
Watchman	8	23	5	20	11	34	24	26
Auto Pump	..	..	1	4	..	..	1	1.1
Sprinkler Alarm	1	3	..	..	..	..	1	1.1
Outsider	8	23	..	..	12	38	20	21.8
Total with data given	35	..	25	..	32	..	92	..
No data	4	..	3	..	1	..	8	..
Total	39		28		33		100	

7. POINTS OF INTEREST FROM FIRE REPORTS.

1409. Boilers should be free for access all around and no woodwork should be in contact with setting.

1933. Have no ventilators which open on side of railroad. Fire was caused by locomotive sparks entering such openings.

2417. It was the general opinion that had the watchman been properly attending to his duties, the fire would not have advanced as far as it did before discovery.

3084. Fire was discovered by an outsider who went to a nearby Gamewell fire alarm box and broke the glass covering the key. He did nothing further, thinking that he had turned in the alarm.

6496. City fire department and employees fought fire with standpipe hose.

388. Remove pitch kettle farther from main building and place it under an all iron shelter. Keep combustible material, such as kegs, etc., away from kettle.

868. As a result of fire in wooden elevator and malt bin, the old wooden elevator legs were replaced by steel and the ground malt bin was replaced by a circular steel hopper with proper relief boards at the top of elevator legs.

1550. Fire ran up stairway and through opening in brick building and then through roof. A blank wall or standard fire door at opening would have prevented fire entering brick building.

6614. Fire caused by spark being struck in malt mill. Superior construction of the building and trunk conveyor undoubtedly prevented a large loss.

716. Exposure fire in adjacent building. Standard wired glass windows would doubtless have kept fire out of building.

6630. Fire in an exposing building was communicated to building by a burning brand which fell on the shingle roof.

50. Fire showed the necessity of having watchman provided with suitable watch clock, and services extended to thoroughly cover the entire premises.

274. Watchman did not begin his rounds until 9 p. m. Fire broke out about 6.45. He would perhaps have discovered it had he made a regular round directly after the plant was shut down at 6 o'clock.

1271. Fire occurred at 1.35 p. m. on a Sunday, at which time there was no watchman on duty. Fire had a good start when it was discovered by an outsider. Had a watchman service been maintained at all times when plant was not in operation, he doubtless would have soon discovered and perhaps have extinguished the fire himself.

3061. Fire was fought by employees with extinguishers and standpipe hose.

5089. As a consequence of this fire, the following pertinent recommendations were found to be desirable.

1. Absolutely prohibit smoking throughout plants and especially in stables.
2. Do not build joist pitch roofs.
3. Do not use wood sheathing unless kept in absolutely perfect repair and having joist channels properly stopped off.

8. SPRINKLER FIRE RECORD.

906. Fire occurred in top of ground malt elevator consisting of wooden elevator legs and head, due to explosion in malt mill. Sprinkler equipment consisted of Manufacturers 1893 heads, wet system, supplied by an automatic steam pump. Elevator chutes, etc., were equipped. Alarm was given by the action of automatic steam pump. One head operated and confined fire to place of origin. No claim made for insurance indemnity.

4193. Fire occurred inside a grain cleaner, from unknown cause, which was located on the first floor under grain bins. Walls were brick, floor concrete, and ceiling open joist. Sprinkler equipment consisted of Manufacturers porcelain seat heads, dry system, with a Manufacturers anti-column dry valve, with probably 750 heads on the system. Primary supply consisted of automatic steam pump which gave a pressure of from sixty to eighty pounds on the sprinklers before operating. Alarm given by operation of electric bell in engine room connected to combination gate and check valve. There were thirty sprinklers in room and seven operated, holding the fire most effectually within the grain cleaner. Fire extinguished by use of water pails. Loss $2382.00 on machinery and contents.

7033. Fire occurred in the wash-house (also used as pitch room). Wash room was a one, equal to two-story brick building, 90 by 280 feet, twenty-six feet high. Roof, tar and gravel over two-inch planks on three by fourteen-inch rafters, twenty-inch centers, twelve-inch posts, twenty-five feet centers. Floor, two and three-fourths inch plank on cinders. Accessory woodwork, such as supports for shafting, braces, elevated walk, and stairway. One wood slatted ventilator thirty by one hundred and thirty feet, and one fifteen by seventy feet, raised five feet above roof. One seven and one-half by nineteen feet skylight, plain glass, in wood frame. Five pitching machines in room, three with brick furnaces built in ground, one with steel furnace, and one with furnace outside building. Room contained several hundred empty pitch-lined kegs at time of fire. Wash-house communicated with frame storage shed (sprinklered) on south, unprotected openings, and with three and four-story brick chip cellars (attic space only sprinklered) on north and west, with four-inch wood doors between, and with one, equal to two, story brick building (sprinklered) containing brine pumps and freezing tanks, protected by tin-clad fire doors. Racking room (unsprinklered) seventy-five by ninety feet, wood floor and wall, built inside wash-house, with floor six feet above wash-house floor.

Wash-house equipment consisted of 138 Grinnell and 102 Rockwood heads on two five-inch dry pipe systems, Grinnell valves. Equipment not standard according to present rules, in that old pipe schedule was used and heads were not staggered. Primary supply gravity tanks of 100,000 gallons capacity: pressure of 28.5 pounds per square inch on highest line in this building. Air on systems at time of fire; pressure of forty pounds at last inspection.

Fire caused by pitch igniting, and was communicated to pitch-saturated woodwork and roof with such rapidity that men doing repair work in

vicinity barely escaped safely from the building. Alarm given before heads opened. Chief engineer, who was on the ground and gave the alarm, stated that heads opened in about one minute from time fire started, and within three minutes sprinklers had fire under complete control. Three streams of hose used to extinguish one or two small fires which sprinklers undoubtedly would have put out.

Number of heads opened, 118, all Grinnell on one five-inch system.

Charred condition of woodwork indicated that fire actually took hold over an area approximating 700 square feet.

Superintendent, who observed action of the sprinklers, stated that sprinkler heads around outside of the fire area opened first, which was probably due to the fact that heads above pitching machines, where fire originated, were coated with pitch from pitch-laden vapors that constantly rise in the process.

9269. Fire occurred in a roof house on malt house, caused by locomotive sparks. No sprinklers operated and no claim for insurance indemnity was made.

9. MISCELLANEOUS FIRES OF INTEREST.

H-6616. An explosion occurred in the keg pitching building adjacent to cooper shop. This building had brick walls, earth floor and corrugated iron roof supported by steel trusses. The window frames were of wood.

It is the custom in all breweries to coat the inside of beer barrels and beer kegs with pitch, whether they be old or new. Pitch is known as "Brewer's Pitch," and comes in barrels ready to melt and use. In this brewery this custom is generally followed: The old kegs or barrels are first brought to the wash-house, filled with cold water, and after ten hours they are emptied and filled with boiling hot water. When the hot water is cold it is emptied out and the outside is washed with a brush and water. They are then examined by dropping an electric light inside through the bung hole to see if there is any broken pitch. If the pitch appears in good condition, the keg is passed along as being all right. If pitch is not in good condition, the keg is repitched inside. Pitch used is mostly imported from Nuremberg, Germany, although there is some American pitch used, and at times the imported and domestic pitch is mixed, but this is not common. To get the pitch inside barrel or keg it is necessary to first melt the pitch at 410 degrees, and then force it into the keg by heated compressed air under eight pounds pressure.

There are several methods of melting the pitch, but the most common is by coal fire under a large kettle, the capacity generally being about fifty gallons. Such was the apparatus used at this risk in which the explosion occurred, and was known as the Universal Pitching Machine, manufactured by Henry Rauch & Son, of Mt. Vernon, N. Y., and had been installed about one and one half years. The other machine which did the same

kind of work and is now in use, was located in same building and beside the machine which exploded. This machine is an old one, and was made by Pawling & Harnischfeger, of Milwaukee, Wis.

Two men were employed in the pitching operation, one man for each machine. On the morning of this explosion and fire, so far as is known, the workmen employed in pitching room followed their usual custom in operation of the pitching machines. Foreman and brew master were in the pitching room complimenting the workmen on the good work they were doing, and on leaving there went to the carpenter shop, which is the next building, and in less than five minutes there was an explosion and fire in the pitching building. Boiling hot pitch (fifty gallons), at a temperature of 410 degrees, flew in all directions. Two workmen, who were badly burned and partly unconscious, were removed at once to the hospital, where both died within a week. Pitching machine was ruined. Doors and windows were open at time explosion occurred, otherwise roof might have been lifted from side walls.

Hot pitch from explosion set fire to carpenter shop and smithy, but, strange to say, there was no fire or damage to adjoining cooper shop building. What fire there was was extinguished by private hose streams supplied by city water and pump, but chiefly by pump. Cause of this explosion is not known and probably never will be known.

If the unfortunate workmen who lost their lives did anything unusual to cause the explosion, that fact is buried with them. If the fire was caused by some person, ignorant of results, placing some explosive material inside the keg which was probably being pitched at the time, either as a joke or premeditated injury to the workmen, it might possibly be one cause to consider in a close investigation.

The possibility of an explosive gas caused by the combination of hot pitch and hot compressed air coming in contact with each other should be investigated.

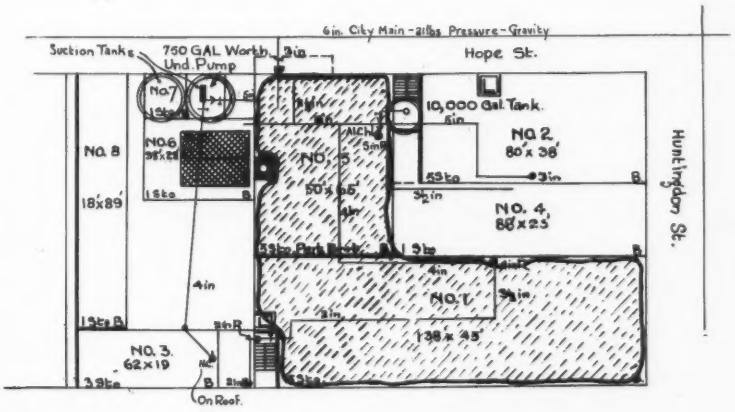
Lesson: This fire illustrates very clearly the necessity, for the safety of life and fire damage, of the pitching apparatus being in a fireproof building well removed from all other buildings.

GENERAL FIRE RECORD.

Unsatisfactory or Serious Fires in Buildings Equipped with Sprinklers.

Where sprinklers fail the cause is, almost invariably, clear. These fires are selected to indicate such causes, that they may be generally understood and satisfactorily met.

S-11856. Tenant Textile Factory. Construction. The buildings involved in this fire had light mill constructed floors of three-inch plank, with top flooring carried on wooden posts. Floors of No. 1 building, where the heaviest loss was sustained, were carried by 8 x 12 timbers set in eight-foot bays, with one row of posts through the center of the building, making a twenty-one foot span. The roof of this building was open joist, carried on timber trusses, at one time sheathed on the underside of the lower chord of the roof truss, but this sheathing had been removed. The roof of No. 5 was hollow joisted. The roof of No. 2 was open joist, with a concealed attic. Stairways in No. 1 were in a brick tower, the



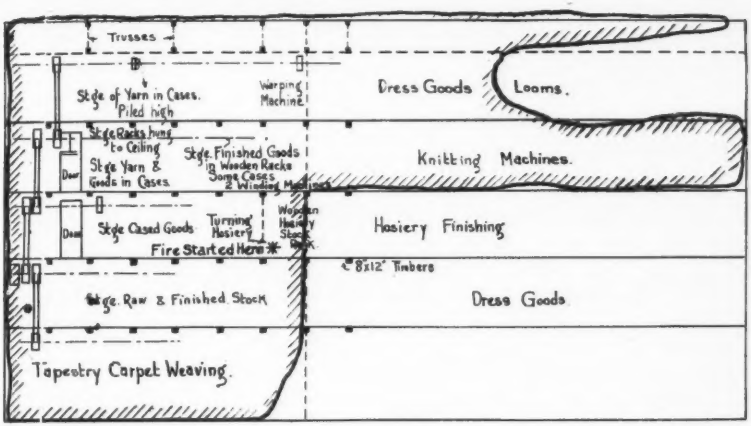
S-11856

elevator adjoining same being in a wooden enclosure equipped with automatic hatches. The only division wall involved to any extent in the fire was between Nos. 1 and 5, and had a number of unprotected belt openings in it and also a number of openings protected by defective fire doors. This wall did not extend through the roof, and the cut-off at the roof and eaves was very poor. There were quite a number of large unprotected belt openings through the various floors of No. 1 in the northeast corner, and also some through the floors of No. 5 on the north side. This was a tenant factory, occupied by knitting and carpet weaving concerns.

Protection. Buildings were equipped mostly with Kane (Universal) pattern of sprinklers, installed many years ago on the old schedule of piping, fairly well arranged except in the roof of No. 1, where the lines were too long, and only three lines installed in a forty-five foot building, the first line being approximately eleven feet from the wall with only one line in the center. This feature, however, did not figure in the final results of the fire. The main feeds were all overhead in the first story, and the riser connections to No. 1 were broken during the fire, but probably after there was no further water supply available. Primary water supply was from a 10,000-gallon tank, about ten feet above the highest sprinkler; and the secondary supply was available from a 750-gallon Underwriter fire pump, taking suction from 40,000 gallons of water in two storage tanks.

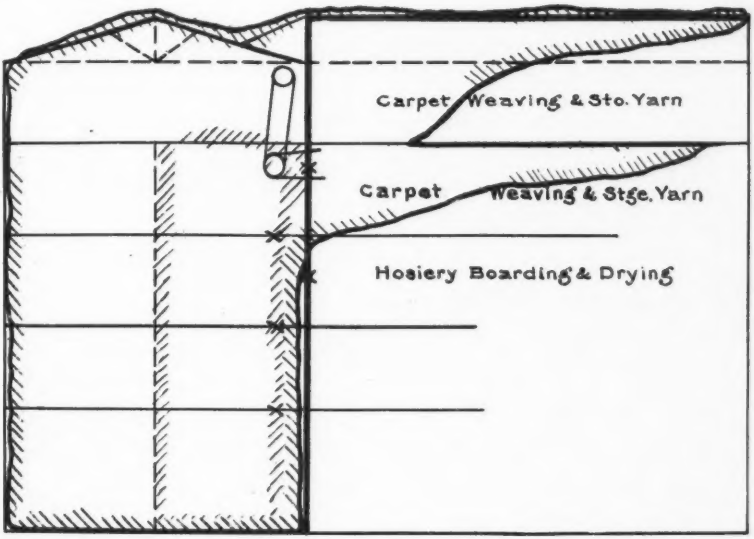
The night watchman did not make rounds or records in this mill Saturday afternoons, as had been previously recommended by inspectors, but was employed in sweeping the towers. He claims to have swept down the stair tower of No. 1 mill, and then the tower of No. 2 mill, and on the completion of this work started to leave the mill. A woman on the street at about this time claims to have seen fire in No. 1 mill, but which was probably only smoke coming from a fire further back. She called the watchman's attention to the fact as he was leaving the premises, and he immediately started to give the alarm, which, however, was turned in by an officer at 5.37 p. m., bringing one engine company in four minutes. The engineer, who was not on the premises at the time, arrived shortly after this fire company and entered the building, and states that he saw fire at the last window in No. 1 building, third floor, overlooking No. 4 building, and also traversed the upper floors of No. 4 building and, aside from some smoke, saw no fire in these stories. All testimony agrees that the sprinklers did operate. The condition of the third floor ceiling corroborates this, and the ringing of the alarm bell was also heard. Valves were found sealed open and the sprinkler tank empty. The sprinklers were evidently supplied with water as long as the tank capacity lasted, which must have been a comparatively short time.

Fire pump, for some unaccountable reason, was never started, all the engineer's time and attention apparently being given to opening doors, locating the fire and assisting the city firemen. This undoubtedly was very poor judgment, as there were at least 40,000 gallons of water in the suction tanks with which the sprinkler tank supply could have been



S-11856. Longitudinal Section

supplemented and the fire held in check. City firemen claim to have had the fire entirely out in the third story at one time and started to overhaul the stock, when they found the fire was in the floor above them, having



S-11856 Cross Section

gone through sundry crevices and unprotected openings and got a fresh start in the fourth story, where the crowded conditions, numerous racks, and so on, were very favorable to breeding a hot fire, and the sprinklers in the floor below had by this time exhausted the water supply, leaving the top floor without protection. After it was discovered that the fire had gained headway in the upper floor, it was fought entirely by hose streams from the city fire department. Fire soon communicated to the entire fifth story, involving the whole roof, undoubtedly passing through unprotected beltways in the northeast corner. It also made its way through belt openings and defective fire doors in the division wall between buildings Nos. 1 and 5, getting into the fourth and fifth stories of No. 5. Fire was probably communicated through the roof construction and eaves at the division wall and through the windows in the angle over No. 4 building. The hollow roof on No. 5 gave considerable trouble.

After fighting the fire in the upper stories of No. 1 for some time, the already overloaded floors, still further loaded by the addition of water held by the stock, gave way in a section about fifty-five by twenty feet in extent, the floors going down completely from the fifth story to the ground floor, shearing off the various beams but leaving the center row of posts standing. The impact of the fifth floor and its contents, which were the first to go, on the fourth floor carried it through and eventually carried each successive floor down to the bottom. Seven firemen were buried in these ruins and extricated with much difficulty. The attention given to the saving of these firemen undoubtedly diverted attention for awhile and gave the fire additional headway. Eventually, city fire department succeeded by the use of hose streams in extinguishing the fire. Eighteen engine companies and a number of hose companies responded to the four alarms and undoubtedly did good service, sprinklers having only been in service a short time until the 10,000-gallon tank was drained.

A loss of about $125,000 resulted.

This fire demonstrated an unusually large number of important facts:—

First: Shows the importance of having regular watchman's rounds and records at all times when a mill is not in operation, as in this case this fire would undoubtedly have been detected in its earlier stages.

Second: The necessity of avoiding all obstructions to sprinkler distribution. Fire seems to have been well held in check in the third story where the sprinklers could reach it, but the fire succeeded in getting into racks and parts of the ceiling out of reach of the sprinklers, and must have gotten to the story above. If the sprinklers had not been obstructed, with proper water supply, there is no reason why this fire should not have been confined to the point of origin and the resultant fire in the upper stories and consequent collapse of the floors avoided.

Third: The danger of overloading the floors is clearly shown from all obtainable testimony, especially in the case of the fifth story where the load, even prior to wetting down and the burning of the floor underneath, must have been excessive.

Fourth: Rapid spread and extent of the fire in the upper stories of No. 1 was undoubtedly due to the entire exhaustion of water in the sprinkler tank, and brings out the importance of a larger and more reliable primary supply for such properties.

Fifth: The failure to use the fire pump was almost an unpardonable neglect on the part of the owners of this property, whose place it should have been to look after this part of the fire protection. The engineer apparently never understood the uses of his fire protection apparatus in this respect and did not know what should have been done under the circumstances. Had the pump been started promptly by the engineer, a good pressure could have been maintained on the sprinklers in action and prevented further spread of the fire, which would have saved the wetting down of goods in the fifth story and avoided the consequent collapse of the floors.

Sixth: The importance of controlling all steam lines from the boilers in the boiler room was clearly shown by the breaking of several steam mains in the mill, but as the pump was not operated this feature had no direct bearing. The fire also clearly showed the danger of having the main feed pipes to sprinkler risers overhead where more than one building is involved. In this case, the collapse broke the four-inch feed line to the riser in No. 1 building in two places and rendered the further control of water supplies impossible. This feature was not directly involved, as by this time the floors in No. 1 had collapsed.

Seventh: This fire shows the possibility of fire pumps being put out of service by the filling up with water of a depressed boiler room, putting out the fires. During the course of this fire, one of the main steam lines was broken and the engineer entering the boiler room to cut this off found that the water had reached the grates and put out the fires.

S-12554. Leather-board Factory. The main mill was 187 feet long by 52 feet wide, basement and two stories, with an annex on the westerly side of mill, basement and two stories, 117 feet long by 38 feet wide. This was flush with the main mill on the northerly end. Fifty-five feet of the southerly end of the main mill was basement and one story. On the easterly side of the main mill there was a one-story addition, 17 feet wide by 159 feet long, used for waterwheels, force pump and stuffing mills. The entire mill was heavy mill construction, with four-inch floors, excepting the roof, which was joisted and entirely sheathed.

The work carried on was the manufacture of leather-board, mainly from sole leather scraps. The basement was occupied by eight large beater engines and other wet processes. The floor above was used for office, storage and finishing purposes, and the entire upper floor of the main mill and westerly annex was occupied for drying and pressing. There was an enclosed elevator in the center of the main mill, and at the northerly end there was an enclosed stairway from the second to the third floors, with an enclosed stairway in the southerly addition from basement to first.

The entire plant was equipped with Walworth upright sprinkler

heads, installed in 1902. Pipe sizes and spacing was 1896 standard. The eight dryers on the top floor were completely sprinklered on the inside by adequate pipes, brought up through the floor from the second story. The supplies for the sprinklers were gravity tank of 16,500 gallons capacity, on a wooden structure, thirteen feet from the northerly end of the mill, the bottom of tank being sixteen feet above the highest sprinklers. In the northerly end of the easterly addition was a No. 4 Hunt rotary pump of 800 gallons capacity and driven by a 300 h. p. waterwheel. The pump was operated by friction gears and controlled on the outside. There was also a Blake Underwriters' steam fire pump, of 500 gallons capacity, in a brick pump house adjoining the southerly side of the boiler house. The supply from the tank entered the basement at the northerly end of the mill, through a six-inch main controlled by a post indicator valve located under the tank with a check valve there. The two pumps were connected by a six-inch pipe and entered the sprinkler system through check valves and post gates underground near the tank at the northerly end of mill. There were also two three-way hydrants and one two-way hydrant, well located, one fifty feet north, one thirty feet west, and one fifty feet south, all properly housed with 200-foot sound linen hose with ample nozzles. The post indicator gates were all found open, and two nights before the fire the manager of the mill is positive the tank was full, because he noticed it overflowing.

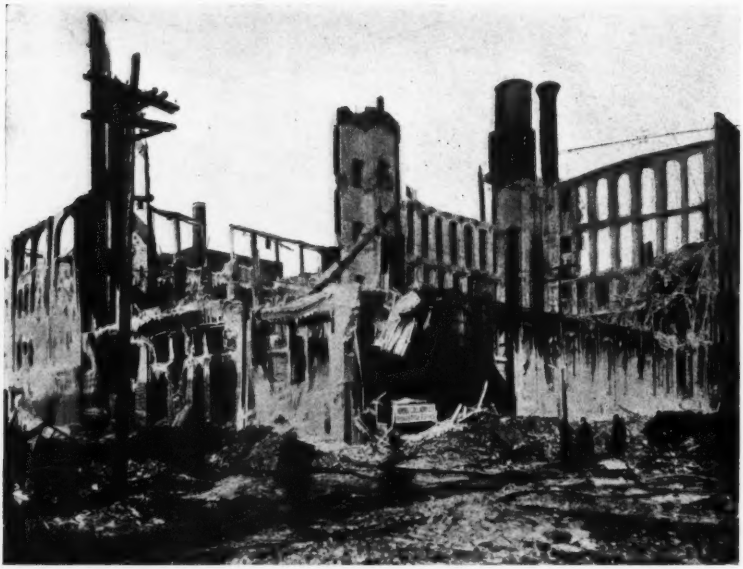
The mill had been operated day and night, excepting Sundays and holidays, constantly since built. There were seven men employed nights, a fireman, an engineer, two men attending the beaters in the basement, two men in the packing and storage room, second floor, and two men to carry stock from basement to the top floor and attend the dryers. The dryers were frame, horizontal structure, eight in number, about thirty feet long, five feet wide and five feet high. The stock was put into them on the sides on crates, built of a wooden frame and wire mesh. The dryers had steam coils at one end, with a suction fan at the other, and each section of the dryers had one Walworth sprinkler. The housing of the fans did not contain sprinklers. The fire was discovered about two o'clock a. m. by one of the men attending the dryers. It is probable that the other man was in the basement and that the drying room had been left alone for some time, possibly half an hour. The cause was unknown, but it is thought it might have been due to friction in one of the exhaust fans. When the fire was discovered, it was apparently at the southerly end of the westerly annex, and it gained considerable headway. The attendant claims that the sprinklers were working but not controlling the fire. He seized a three-gallon chemical extinguisher and discharged its contents upon the fire, which being both outside and inside of the dryer did not control it. Without giving an alarm he went below for another extinguisher, but the smoke prevented his return to the top floor. He then gave the alarm in the basement and the whistle was sounded. The manager, who lived a short distance away, was awakened by the alarm and found fire coming from several windows on the side and the end of

top story of annex. He got to the mill as soon as possible and found the floor pretty well on fire. The sprinklers appeared to be discharging on the top floor and some on the floor below. The fire was coming through the second floor at that time. The workmen had started the rotary pump. The steam pump was put in operation and six streams of water from hydrants were soon in use with ample pressure, but in spite of their efforts the main mill was entirely consumed, the fire lasting two hours or more. A brick storehouse north, a frame storehouse south, and the engine and boiler house were saved.

The explanation of the failure of the sprinklers to hold the fire seems to be: Sprinklers were Walworth, improved upright, which have proven unreliable; 300° heads in dryer where fire started, which are especially slow and unreliable; obstruction to distribution in dryer by the leather-board sheets, the consequent opening of a large number of sprinklers early in fire, probably reducing effectiveness of the tank supply; delay in fighting fire with hand chemicals before starting pumps and consequent large number of sprinklers opened by that time; the use of a large number of streams, taking water from the sprinklers, especially after the 1,000-gallon rotary pump was disabled and the ineffective use of the fire streams by inexperienced men. A large loss resulted.

Summary: Slow or defective operation of high test heads and obstructions to distribution.

S-12530. Box Shook Factory. This was a brick and frame wood box factory with boiler house adjoining and not cut off. Shavings vault was located directly in front of the boilers and not cut off from mill or boiler room. During the watchman's eleven o'clock round, he discovered smoke coming from above the shavings vault, and immediately turned in a public alarm. Cause thought to have been spark from boiler which ignited fine dust about shavings vault. Fire department responded and with the assistance of sprinklers (two or three supposed to have opened) extinguished the fire, as they supposed, with their hand chemicals. The sprinklers were then shut off and fire companies dismissed. It was said that not all the apparatus had left the vicinity before the fire suddenly started up again, and with the sprinklers shut off, it got considerable start before a stream of water could be applied by the fire department. As a result, fire spread to all portions of the second floor of both main mill and frame wing, opening every sprinkler on the floor. The fire chief, not wishing to turn in a second alarm, recalled the departed apparatus by telephone and neglected to turn on the sprinklers. Five hose, two steamer and one chemical company were finally brought into service and extinguished the fire with six or seven hose streams. The entire second floor of buildings were considerably charred and about one third of the roof of the main mill ruined. This heavy loss was no doubt due to the poor judgment used in handling the fire. The original fire did not receive the careful attention it should, and had water been turned on to sprinklers when the second fire was discovered, there is little doubt but



S-12160

that the loss would have been much less. Sprinklers remained shut off all through second fire.

Summary: Water shut off before fire was out.

S-12160. The destruction of this factory was due to a combination of adverse circumstances: Cold weather, strong west wind which carried fire from exposure into this building, a few frozen hydrants, the seeming difficulty in getting sufficient water, etc. Firemen could not have lived on roof of five-story sprinklered building to fight fire with the hose here, and no consideration was given to the siamese steamer connection on east wall of building, which could have been used to advantage in supplying sprinklers, especially at the start of fire. The fact that tin-clad shutters on west wall were poorly designed (those on fifth floor were twelve feet high) was a strong factor in admitting fire into buildings from exposure, but it is a question whether full standard shutters could have withstood such a sea of flame driven by the strong wind. A blank parapet fire wall on west would probably have saved this building. It should be noted that the plank and timber floors of exposure made an extremely hot fire, especially when roof had fallen in. Loss heavy.

Summary: Exposure fire.

S-12546. Paper Mill. Fire was discovered by boiler tender about 10 p. m., in the upper part of old boiler house near the induced draft fans. It extended rapidly, involving the entire roof of old boiler house, the fan

building, end of the new boiler house, and the roof of old and edge of new recovery buildings. The sprinklers in the boiler house and fan room had been disconnected about two months previously, when changes were made in the yard system to accommodate the new boiler house.

The whistle was blown but the fire gained headway so rapidly on the hot woodwork that the whistle, which was located on the boiler house roof, was soon interrupted. The night force at the mill, however, got out the hose, and soon the manager, superintendent and day foreman were notified. Seven hose streams were put in service from four hydrants. Good work was done in keeping the fire out of the nearby wood room and digester building which were connected by bridges.

The fact that the fire extended nearly all over the old recovery room roof was of particular interest, as this building was provided with a modern sprinkler system well supplied with water. All the heads in this room opened (72) and six in the new recovery room beyond. They were all 286° Grinnell corro-proof heads. The roof was pretty generally charred and burned through in several places, notably along the side wall and under false roofs, built up a few inches between the old and new recovery buildings to throw rain water into the gutters. The sprinklers undoubtedly all had water at moderate pressure. No heads were found with the temper gone. They held the fire in check, but it was a slow process to extinguish it under the false roofs. It was found necessary to shut off the sprinklers and use hose streams exclusively for this purpose.

There were several probable causes for the sprinklers failing to keep the fire out of this room. The first was that there were several large unprotected openings from the boiler houses and fan room to the old recovery room. Four of these were from over the boiler and the immediate vicinity of the fans, where the fire started. Over these openings in the recovery room was a platform and a chip conveyor which prevented the sprinkler water from reaching the fire, and provided a good supply of quick-burning fuel. This room was always very hot, keeping the roof in a condition such that it could ignite readily. In the early stage of the fire the electric current for the motors for the forced draft fans for these furnaces was interrupted. An emergency stack was provided with a damper, but in the excitement it was not opened, therefore the heat from the furnaces was thrown out into the room. The high temperature heads probably opened slowly and gave the fire a chance to spread on the hot ceiling.

The very rapid spread of the fire throughout the boiler room and fan room was undoubtedly owing to the high temperature at which the woodwork was kept by the induced draft fans and flues. The boilers were provided with a combined forced and induced draft. Originally there was an evaporating tank in the path of the smoke before it reached the induced draft fans. This had been out of service for several weeks and the temperature of the flue gases had probably been 600° or thereabouts at times. In all probability the floor near these fans was where the fire started.

Summary: Unprotected openings and obstructions to distribution.

S-12539. Glass Plant. Factory consisted of a one-story frame building on partly frame studding, posts and trusses, and part steel frames. Original plant was metal-clad, to which had been added from time to time several frame additions for the storage of materials and finished bottles, the whole covering an area of about 28,000 square feet. A one-story concrete machine shop was detached twenty-five feet, and a one-story frame mold shop and storage building detached about fifteen feet. The glass factory was occupied as an experimental plant, and contained one six-ton brick and cement glass melting furnace, one new furnace under construction, one brick lehr, two gas producers, one bottle blowing machine, boilers, engines, pumps, dynamos and motors.

Plant was originally equipped in 1907 with Grinnell automatic sprinklers. The sprinkler equipment was provided with central station supervisory service and a watchman employed. Since the installation of the original equipment, numerous small additions from time to time required the placing of additional air valves to prevent overloading. Work of this nature was being carried on at time of the fire. A new furnace, lehr, some changes in a portion of the roof, and small additions made necessary one additional six-inch air valve, and the change of location for three of the old valves. This work, begun in January, was to be carried on gradually, keeping as little as possible of the system out of service at one time. The air valves were grouped three in one valve house and two in another, and were properly connected to the underground supply. Three of the systems were in a completed condition and two were not, the latter having open six-inch risers that had not been connected to the mains. The supervisory service reported the gate valves closed January 20th, and restored to normal condition January 21st, after which, until the time of the fire, the system was reported as "working O.K." This was afterward explained to mean that the equipment in other buildings was in proper condition. These reports were misleading, as they should have been complete and covered the conditions throughout the entire plant.

About 6.20 p. m., Saturday, March 2d, while the watchman was stationed at two salamanders, which were burning outside the building near a doorway in a canvas-covered enclosure, an explosion occurred, apparently caused by a leaking natural gas pipe just inside the building. The watchman, though badly burned, turned in an alarm over an A. D. T. box. The fire department promptly responded. Upon their arrival the flames had spread rapidly throughout the building. A second and third alarm were turned in, bringing additional apparatus, and in a short time sixteen streams were playing on the fire. The flames could not be checked and the building was destroyed. The siamese steamer connection could not be used, as the post indicator valves were closed, shutting off all water supply. The opening of the post indicator valves at time of fire would have been of no service, as the inside gate valves on the two uncompleted

systems were open and the water would have discharged through the open six-inch risers.

It is claimed by the sprinkler company that the work was being done by day labor, and their men were through and discharged until the completion of the roof would permit the finishing of the two uncompleted systems. Had the water been turned on the other three systems, the plant would have been saved. A large loss resulted.

Summary: Water shut off.

S-12533. Paper Mill. A new finishing room building of brick with flat roof had recently been completed. This roof was on line with the peak of roof of the old machine room building. This change in construction required a rearrangement of the sprinkler protection, as the changes made the old piping too low for the sprinklers to give protection to the new roof. One of the employees was making repairs on one of the cone drives for a paper machine and was using an open petticoat light. He probably upset his lamp, which ignited the lint and grease. He stated that suddenly he saw fire run over the cone, and although he tried to extinguish it with an extinguisher, it spread rapidly into the roof. One of the management being nearby, immediately ordered hose streams put on. Eight lines were used by the mill and one by the public department. These streams were supplied by the mill pump, which the engineer stated had seventy-five to eighty pounds water pressure at the pump. It was about two hours before the fire was extinguished.

About thirty sprinklers opened, part of which were Grinnell glass button and the remainder metal type. The owners state that the sprinklers opened promptly, water coming from them before the first hose stream was in operation. While a few may have opened promptly, it is possible that some were slow in opening on account of paint on the strut, and one head which was taken from the line near the peak of the roof, was found to be full of sediment, which allowed little, if any, water to pass through. Attention was called to this sprinkler on account of the burned condition of the roofing overhead. The sprinklers as a whole were evidently of very little service in extinguishing the fire, and but for the excellent manner in which the hose streams were used by the men, the fire would undoubtedly have done far greater damage.

Summary: Painted heads and sediment in pipes.

S-12656. Theatre. The building was old, of ordinary wood joisted construction, with tar and gravel roof; first floor occupied by a saloon, restaurant and fruit store; second floor by the Academy of Music, seating capacity 1,600. The fire, as nearly as could be learned, started in the rear of one of the stores above the metal ceiling in the joist directly under the boxes of the theatre, and in a very few moments was eating its way up a wooden asbestos lined wire shaft which ran on the stage side of the proscenium wall, thus allowing the fire to communicate with both the auditorium and stage simultaneously. A still alarm was sent in by a pedestrian, and two more alarms were immediately sent in calling out the entire fire department of the district. Before all of the fire apparatus arrived the fire had

S-12656 From *Pittsburg Post*

S-12656 From *Pittsburg Post*

worked its way through the roof, and the structure was doomed. The firemen used their best efforts to protect adjoining property and confined the fire to the building in which it originated.

The proscenium wall was built of four-inch pine, tongued and grooved, and ran to the underside of roof. No gridiron was used, all tackle being supported on roof joist. Dressing rooms were constructed of matched pine under the stage. The asbestos curtain at time of fire was up about five feet above stage, so the fire had practically no resistance and was no doubt helped along by the additional draft through opening in the proscenium arch.

Protection. Watchman maintained at all times, but no clock was used. Supply of barrels and buckets and a 40-gallon chemical extinguisher on wheels. Two 2½-inch standpipes having hose connections on each side of stage on fly galleries and in basement, with 50 feet of hose attached to each connection, in addition to one 2½-inch hose connection with hose attached on second balcony of auditorium.

A one supply automatic sprinkler equipment was installed over and under the stage, but for unknown reasons main valve had been closed and was found in this condition shortly after the fire. The fire started in an unsprinklered section of the building and was well under way before the sprinklered section of the building was reached, and it is doubtful if the sprinklers would have held the fire out of this section, although no doubt they would have rendered valuable assistance.

None of the private fire apparatus was used. The watchman who was standing in front of the theatre, when told of the fire, rushed into the building, but the smoke was so dense he could do nothing.

Summary: Water shut off.

S-12566. Metal Worker. Manufacturing Swords. This was a three-story brick building partly of mill construction, but with third story and attic of open joist construction. Only the attic of this building was equipped with sprinklers. These were Grinnell issue D sprinklers, on old pipe schedule and not staggered. Primary supply was waterworks, which gave a pressure of eighty pounds on the heads that operated. Fire occurred from unknown cause on unprotected third floor and worked its way into attic. Sprinklers all operated, but failed to hold fire in check.

Summary: Unsprinklered portions.

S-12564. Department Store. Fire occurred in small stock room on top floor. In this room there was a closet six feet deep and forty feet long, with open front, containing show window draperies and decorations. This closet had a solid top with no sprinklers inside. A line of sprinklers over this locality was so badly obstructed that fire burned freely, and heat spread sufficiently to open heads at the extreme width of the room. Extinguished by fire department. Considerable water damage.

Summary: Obstructions to distribution.

Fire-Resistive Buildings---Fire Record.

These fires are selected to illustrate the behavior of various forms of fire-resistive construction under exposure to fire from within or without.

H-7389. Knickerbocker Trust Building, New York City. Construction. As originally erected in 1908 the building was 8 stories high, with basement and sub-basement; in 1911 it was carried up to 23 stories. Steel skeleton construction was used; roof structures of 4″ tile. Area of building is 9,100 square feet. Walls are brick, curtain, independent 28-24-16-12; with stone faced fronts, brick backed. All walls are plastered direct; no furring being used, except the hallways are finished in marble. The hallways and office partitions are built of 4″ tile with sidelights and doors of wood sash with thin glass. Cornice stone. There are 15 skylights of wired glass on roof.

The floors of offices are of ⅞″ wood on wood sleepers, the hallways of artificial stone, all on cinder concrete fill, on 9″ flat tile arches, on 12″, 31½-pound to 8″, 18-pound steel I beams 5′ 6″ to 4′ 3″ on centers, on 24″, 84-pound to 15″, 60-pound steel I girders 19′ 6″ and 15′ 4″ on centers, on built steel columns of channels and plates, box type.

Fireproofing. All beams and girders are protected on web by arch construction, on flanges by 1½″ to 3″ skewback tile with shoe; all columns are protected by 3″ of tile with air space. The ceilings are plastered directly on the bottom of the floor arches.

Floor Openings. There are 8 elevators in two shafts, each shaft from basement; one through roof, covered by a thin glass in metal skylight, the other shaft is to 16th only. There are two stair shafts, one from 3d to 16th and the other from 16th through roof is covered by a skylight of thin glass in metal; also one pipe and wire shaft and one vent shaft each from basement through roof. Vent shaft has suction blower at roof. All of the above shafts are of 4″ tile; otherwise there is a stairway sub-basement to 3d open in hallways (see Partitions). Stair shafts open to hallways by kalamein doors with wired glass panels; elevators open to hallways by open iron grille basement to 20th inclusive, on 21st to 23d inclusive by kalamein doors with wired glass panels. Vent shaft opens to toilets by iron registers; pipe and wire shaft opens to hallways by steel lined panel boxes. There are also in the Recess Club openings as follows: one flight of stairs 20th to

21st, also one stair shaft 21st to 23d inclusive enclosed similar to main stairs. There is also one dummy shaft of 4″ tile from 21st to 23d inclusive covered by thin glass skylight and opening to floors by kalamein doors.

All of the stairs are of stone treads on iron frames on steel web plates. Elevator motors in top of shafts.

Origin and Spread of Fire. The fire started in the busheling department in the rear of a haberdasher's store in basement and, though it is not definitely known, it is thought to have originated from electric pressing irons. The installation of the irons had been inspected and approved. Under normal conditions they should not have caused any trouble.

The store was closed for the night at 6.30 p. m. and about 3.20 a. m. fire was discovered by a police officer and the building watchman. They simultaneously at 3.21 a. m. turned in alarms, one by city fire alarm box and the other by the National District Telegraph Company's fire alarm system in the building.

The fire spread over the entire rear portion of the store and worked its way well forward before it was extinguished. It destroyed a large portion of the contents of the store, the balance being badly damaged by smoke and water. The store has unprotected communications with the main hallway, but the fire did not spread thereto.

Damage. In addition to the loss of the above mentioned stock, the trim in the store was badly damaged, but otherwise the building is practically uninjured. Water thrown on the fire went through the floor with comparative ease, but the damage done was small.

H-7460. Oil Clothing Factory. Fire occurred in the fifth floor of a building of reinforced concrete construction throughout. Fire was caused by spontaneous ignition of oily rags which had been used by men for wiping their hands after applying the waterproofing material to cloth. This material contained linseed oil. Rags were left in a barrel near a bench. Fire was extinguished by one chemical stream used by public fire department. A window casing, bench and several brushes were damaged and room was smoked up.

H-7590. County Court House. This was a building having heavy masonry walls, with floors of concrete arches on corrugated iron buckle plates, supported by eight-inch I-beams spaced three feet apart. The I-beams were not fireproofed. Ceilings were metal lath and plaster on light angle irons. A mansard roofed attic and clock tower contained considerable woodwork. Walls were finished with panelled wooden wainscoting. Fire originated in clock tower. This tower collapsed, carrying a heavy bell and statue through to the first floor. Loss $125,000.

H-7492. Office Building of the Emerson-Brantingham Company, Rockford, Ill., February 28, 1912. Description of Building. Brick, three stories, tile and reinforced concrete floors and roof, supported by reinforced concrete posts and beams. No wood top floors, and only material to burn consisted of windows, internal trimmings, office furniture, and low partitions, all largely of oak. Building was 210 x 62 feet, detached, and had no internal protection, being dependent on the standard fire equipment of the

works, consisting of hydrants fed by two 1,000-gallon Underwriter pumps and a large tank on 100-foot trestle. The first floor, devoted largely to show-room of agricultural implements; second floor, general offices subdivided by numerous wood partitions of glass and wood nearly all about eight feet high; third floor, dining-room and supply room.

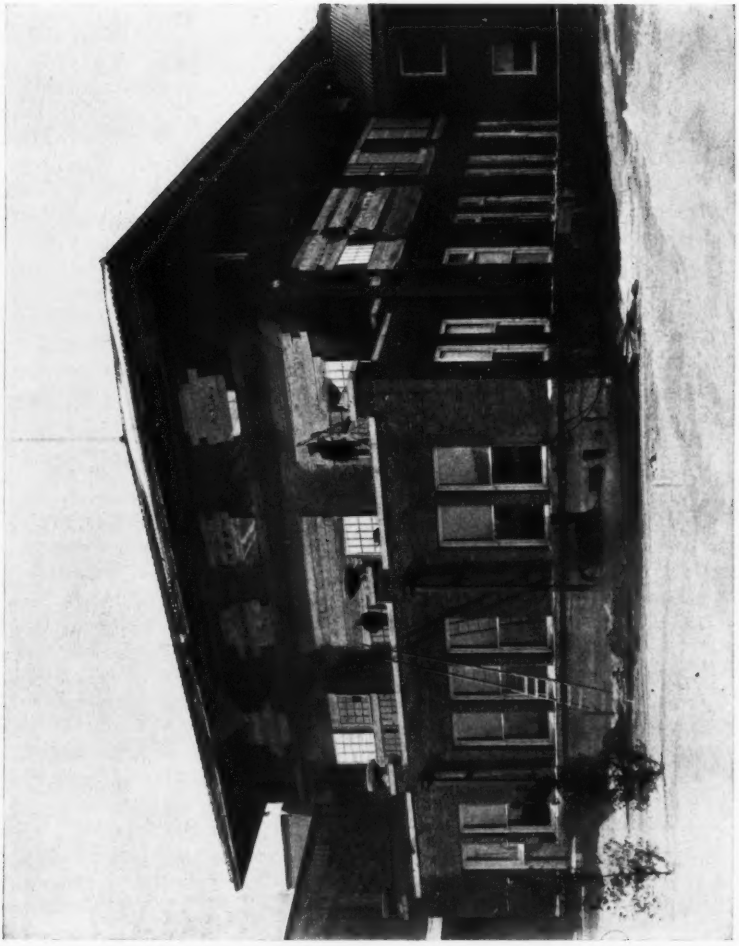
The Fire. The fire occurred on second floor of office building. The first and third floors were not seriously affected, but were damaged by smoke and water, as the substantial construction practically confined fire to the second floor, where it started at the east end about 10.30 p. m., due, it is understood, to carelessness on the part of office force, members of which had been at work during the evening and had been smoking. Watchman reported everything right at 10 o'clock, at which time the men in office were making preparations to leave. Fire was discovered bursting from windows at east end, second story, and by the time fire streams were applied, it had extended over the easterly half of the room. Shortly after, a so-called "hot-air" explosion drove men from the room and spread the fire throughout its entire length of about two hundred feet, shrivelling everything combustible and cracking the heavy window-glass at extreme west end. The fire passed up the marble and iron stairway to third floor and, bursting also from windows at east end, burned out windows above and thus entered the third floor, but gained little foothold owing to absence of much combustible material there.

Effect of Fire. Practically everything in the main room on second floor was destroyed, including many valuable office records, the lower floor being seriously damaged by smoke and water. On the second floor, twelve of the concrete posts were spalled so as to materially reduce their size, but they can be repaired. Three concrete beams in ceiling had reinforcing rods exposed, and much of the cement plaster and the under side of the tiles dropped in places. The upper part of the east brick wall cracked, due to expansion of the floor, and part will need to be rebuilt.

On the third floor the fire cracked the cement window-sills at east end, and the cement belt around the building at this floor was cracked and spalled. The north and south walls were pushed slightly out of line, showing the effect of the expansion of the floor, which was also illustrated by the photograph of the cracks in the marble mosaic floor of the dining room.

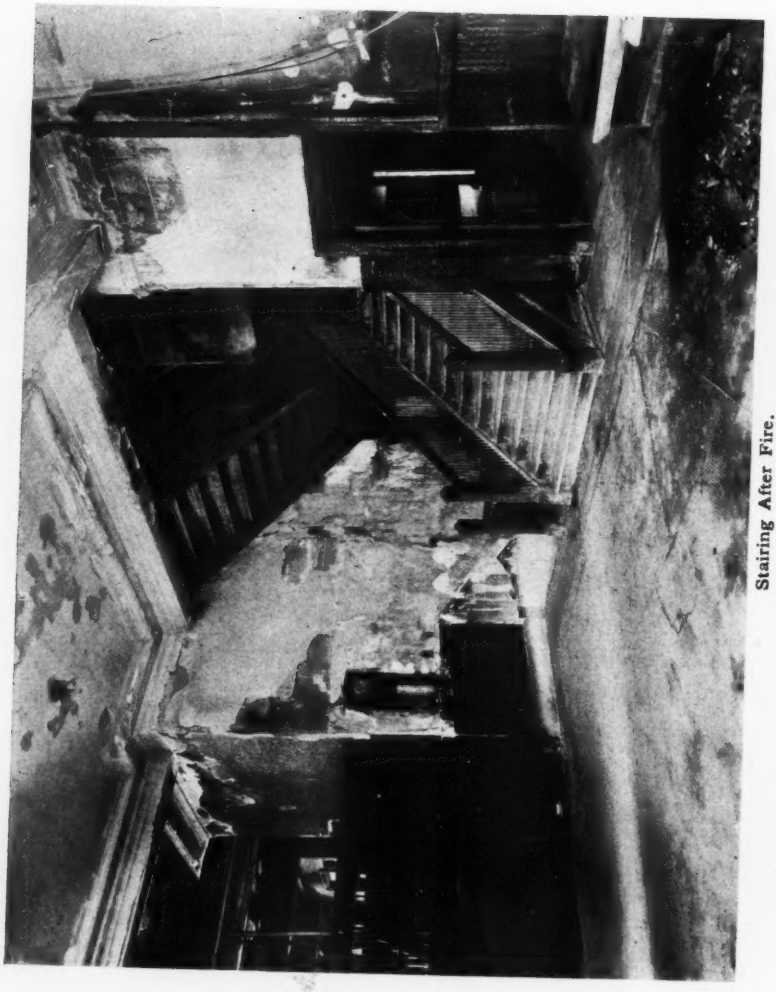
It was somewhat surprising that the amount of heat developed by the burning of the office furniture, papers, etc., should have caused such excessive havoc with the material used in the construction of the building. It is to be noted, however, that the essential members of the building and its supports, as shown by loading tests made after the fire, indicate that the strength was not impaired, and that these will not require replacement, the expense necessary being largely on what might be called the superficial part of the building. The loss was about $75,000.

The fire again emphasizes the fact that the large general office buildings now being built in our cities are exposed to this same hazard, and that adequate safeguards should be provided, especially in those of considerable height.



View of East End Office Building after Fire.

Marble and Iron Stairway.

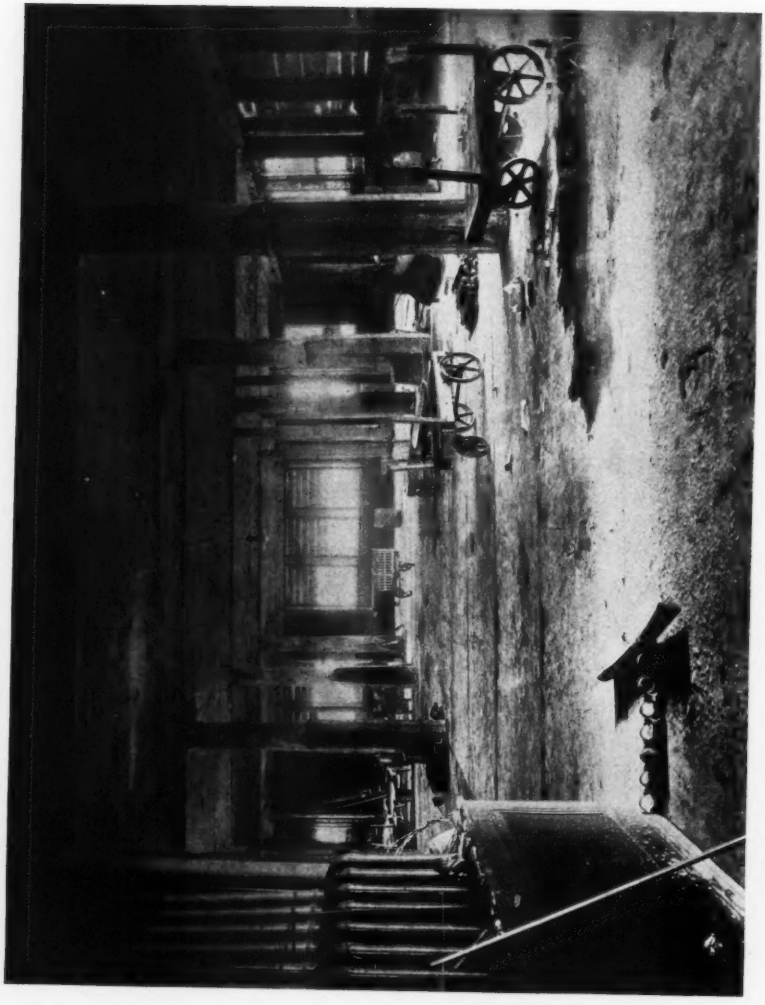


Stairing After Fire.

Showing marble wainscoting, stairs, floor and ceiling as attacked by fire; also burned woodwork.

East End Second Floor.

Fire started in center at extreme end beyond the glass partition. This illustrates the character of the room and the freedom from any considerable overhead partitions which ordinarily add so much to the combustible material on which a fire can feed.

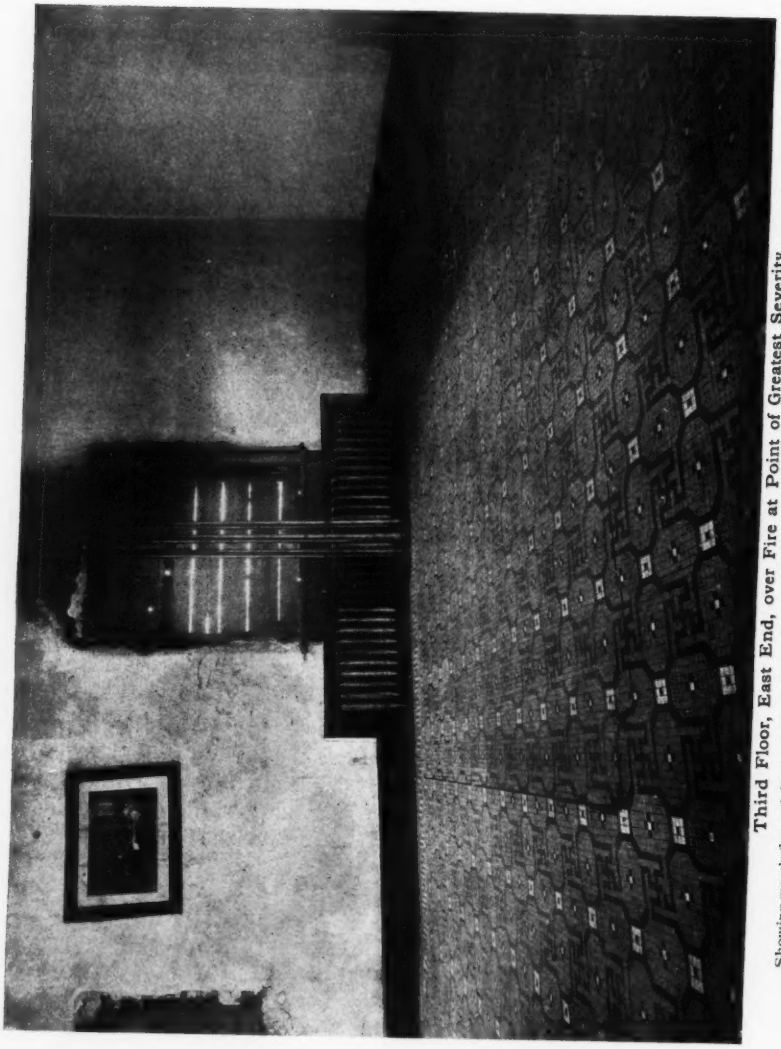


East End Second Floor after Fire.

Heat of fire was sufficient to melt brass in the pneumatic conveyor system shown and in a few other places.

Northwest Section of Second Floor.

Note the exposed reinforced cement in columns and beams and the plating put in—fearing collapse—which, however, was found unnecessary, as subsequent tests showed strength of columns and beams not impaired, and replacement of superficial cement only was necessary.



Third Floor, East End, over Fire at Point of Greatest Severity.

Showing mosaic floor of dining hall cracked by heat of fire below, which caused expansion sufficient to push out slightly the north and south walls.

H-7357. City Investing Building, New York City. Construction and Occupancy. Fireproof office building; 26 and 32 stories; steel frame construction; 4″ tile shafts at floor openings, mostly wired glass, iron or kalamein door protection at openings; terra cotta protection on steel work, 4″ on columns and 2″ on flanges of beams and girders; terra cotta tile floor arches.

Origin and Spread of Fire. The first intimation that any of the employees in the building had of the fire was when the circuit breakers on the switchboard opened. These breakers were closed by one of the attendants, but owing to a heavy "short circuit" he was unable to keep them closed. An investigation was made, and the fire was located in the east wire shaft which runs from basement to the roof of 32-story portion and contains electric light and power wires in conduit, as well as telephone, telegraph and ticker wires in cables. The shaft is enclosed by 4″ terra cotta; doors of ⅛″ sheet iron with angle iron framing. Former tenants from the burned Equitable Building having hurriedly located in the City Investing Building, the telephone company was obliged to install additional cables, and their mechanics had been pushing their work in this shaft as rapidly as possible. At the level of the different floors there are iron grille platforms in the shaft to enable workmen to operate. It was found that owing to a strong draft it was impossible to work with any comfort, or to operate blow torches for the purpose of melting paraffin and soldering wires. These iron grilles were therefore covered with material which would shut off the draft. Ordinary burlap is said to have been used, and it is thought that this, together with the exposed insulation of the telephone wires where the lead armor was removed, were ignited by sparks from an electrician's soldering torch.

The fire department utilized the standpipe equipment of the building to extinguish the fire.

Damage. The damage was mostly confined to the electrical equipment inside the shaft, consisting of cables and insulation on same, also the electrical elevator control apparatus at thirty-second floor. There was considerable damage to woodwork used in roof construction; the sloping roof of the thirty-two story portion is covered with sheet copper on wooden purlins about 2″ x 4″ set 28″ on centers between 3″ tile on T irons; this portion of roof also had two small thin glass side lights in wood sash, which burned out and afforded a vent for the fire. A few wooden coat and hat racks in porters' closets over doors to shaft were also slightly damaged.

Conclusions. While the fact that this fire did not result more seriously is quite a tribute to the building from the viewpoint of fireproof construction, it has, nevertheless, developed two interesting points of weakness.

First, is the introduction of unnecessary inflammable material inside the wire shaft.

Second, the use of wood nailing strips in connection with the roof construction over the thirty-two story portion. This seemingly unimportant detail, together with the ordinary wood sash windows in the same

roof, is responsible for considerable damage which would otherwise have been avoided.

H-7339. Vanderbilt Hotel, New York City. Construction. Built 1911. Twenty-one story (with a mezzanine between first and second floors) and basement, sub-basement, cellar and sub-cellar, fireproof building of steel skeleton construction; roof structure from one to three stories in height of tile and concrete, covering about one-third of building. Area 15,800 square feet; there are two exterior courts facing on Park Avenue with one-story portions in courts. Walls brick, curtain independent 24″ to 12″; street fronts (3) brick with glazed tile trim; interior finish of plaster on 2″ to 3″ tile furring. Parapets 3′ all sides. Partitions mostly 3″ (partly 4″) tile enclosing rooms and halls, drawn sheet steel doors with casings and trim of same character and metal louvered ventilating transoms. Cornice tile. Skylights over shafts only. Floors tiled basement and first, otherwise cement on 4″ cinder concrete flat arches except second floor which is mostly on Gustavino arches of three thicknesses of 1″ tile laid in Portland cement on 15″, 42-pound steel I beams forming bays about 15′ x 15′ containing the arches. On other floors the beams range from 8″, 18-pounds to 12″, 31½-pound, 4′ to 6′ on centers; on steel I girders ranging from 12″, 31½-pound to 20″, 65-pound, 10′ to 17′ on centers; on steel columns built of plates and angles, on I beam grillage laid in concrete, on piers to rock. Roof tile laid in cement on arches and supports same as floors. **Fireproofing.** Beams and girders protected by arch construction on web and 2″ cinder concrete on flanges. Columns protected by 3″ tile leaving air space in column channels; the protection of several columns is weakened by enclosed pipes and electrical conduits. Ceiling plastered on under side of floor arches except ceilings of basement (in restaurant) of ornamental glazed tile. **Floor Openings.** Stairs from sub-basement to first irregularly located and cut off between floors by tile partitions, asbestos filled, with drawn steel doors. Three stairways above first floor in enclosures of 4″ to 6″ tile with doors of same type as above. Three elevator shafts above basement, one of three cars, one of two and one single, all of 4″ to 6″ tile, with doors of same type as above, having wired glass panels in part. One three-car dumb-waiter shaft of 4″ tile from pantries in sub-basement to roof, drawn steel vertical sliding doors at openings to serving rooms on second, third, eighth, eleventh, fourteenth, seventeenth and eighteenth floors. One shaft of same construction from kitchen in sub-basement to first floor. A number of pipe shafts built in hallway partitions, of 4″ tile, No. 16 gauge sheet-iron doors to halls. The windows in west (rear) wall opening from corridors are of wired glass in kalamein sash and frames.

Cause of Fire. The fire originated on the fourth floor, near the north end in the main corridor in a large quantity of furniture packed in excelsior, carpets open and in rolls, and other furnishings, which workmen had been engaged earlier in the day in unpacking and placing throughout the rooms. Cause of the fire not definitely known; it was discovered by an elevator operator. The private fire alarm apparatus connecting with the

engineer's office in sub-basement was at once operated. At the same time an alarm was turned in to the fire department from a street box. The employees at once attacked the fire with the private apparatus, which consists of three 6″ standpipes, each with 100′ of 2½″ standard, labeled linen hose attached at outlets on every floor. The water supply is from two tanks, having a combined capacity of 20,000 gallons; also from an Underwriters compound duplex fire pump with a capacity of about 500 gallons per minute. The standpipes also have outside siamese connections for fire department. Upon arrival, the members of the public fire department confined themselves to the use of this private standpipe equipment. The fire was soon under control.

Extent of Fire. The fire, although intensely hot, was confined to the floor where it originated and largely to the north half of that floor. The absence of all woodwork in the interior construction and trim afforded the fire but little opportunity to spread. The steel corridor doors to rooms and floor openings withstood the fire well and held it in check wherever they were closed. The doors into several of the rooms were, however, open at the time, thus permitting the flames to enter nearly one-half of the rooms on the floor.

Property Loss. The loss was confined chiefly to the new furniture and carpets stored in bulk at the point where the fire started, most of which was destroyed or seriously damaged. The damage to the building was comparatively slight and confined strictly to the fourth floor except some water damage to the first floor ceilings, the intermediate floors apparently having suffered no injury. The plastering on the fourth floor was scaled off where the fire was hottest, but the tile furring and under side of cinder concrete arches were not damaged.

Conclusions. The confinement of this intensely hot fire to a relatively small space on the floor where it originated, was doubtless due to a great extent to the fact that all openings into stair and elevator shafts and also those in corridor and room partitions were provided with fire doors, and to the absence of all wood or other combustible material in the interior trim and finish of the building, thus illustrating the marked advantages of this character of construction.

A fire of this nature in a building less thoroughly fireproofed would most likely have resulted in a far more serious loss, if not the practical destruction of the building.

S-12543. Department Store. The fire occurred in an enclosed space about 1¼ inches high, three feet wide and twenty feet long, formed by the asbestos covering of metal boiler flue and terra cotta tile ceiling of boiler room. The metal flue was covered with 1½-inch asbestos plaster on expanded metal secured to angle irons, forming a one-inch air space between metal flue and covering. The vertical sides of asbestos covering extended clear to terra cotta ceiling, which formed 1¼-inch enclosed space mentioned above.

The floor, forming ceiling of boiler room, was of flat arch terra cotta

blocks twelve inches thick, set end to end between steel I-beams. On top of terra cotta arch was six inches of cinder concrete fill containing wood sleepers for ⅞-inch maple flooring. Seven-eighths inch boards twelve inches wide were placed under the floor on I-beams for centering the terra cotta blocks while forming the flat arches. After the arches were in place the boards were removed, except two which were left in the small space directly above boiler flue. This space was then enclosed when metal flue was covered with asbestos, and the vertical sides of covering extended to ceiling.

The engineer stated that he had notified the builder regarding these boards. The builder is said to have promised to remove the boards, but neglected to do so. The heat from metal flue penetrated the 1½-inch asbestos covering and ignited the boards that were left in the enclosed space. The heat from the burning boards passed through the crevices between the twelve-inch terra cotta blocks of floor arch and allowed the fire to reach the concrete cinder fill. The six-inch concrete cinder fill contained a large percentage of coke cinders which ignited. This concrete cinder fill was burned through and the ⅞-inch maple flooring and wood sleepers were gradually being consumed when chief engineer discovered the fire.

The engineer used three chemical extinguishers, and in the meantime sent watchman to nearby engine house for help. One man responded and cut away floor with axe and wet down the cinder fill. The fire, which was apparently extinguished, broke out again at 10.30 p. m. of the same day, and was discovered by watchman. He phoned to engine company. The firemen responded, cut away a section of floor about six feet by twenty feet and removed the boards that were mostly burned in the small space above metal boiler flue. Considerable amount of asbestos covering was removed in order to reach the boards.

The damaged cinder fill was removed and replaced with concrete and cinders. The ⅞-inch flooring and asbestos covering of boiler flue was repaired.

The fire probably burned for several days before discovery.

Miscellaneous Fires.

Interesting fires are given under this heading without regard to their classification.

H-7613. Wholesale Rag and Junk Dealer. This was a three-story and basement brick building divided into two sections by a fire wall. This wall had two door openings on the second and third floors. These were protected by double standard labeled fire doors. All the doors were open at the time fire occurred. They operated successfully in all cases, but the doors failed to close at one opening, due to storage of baled goods in the passage. One of the doors at another opening was held back by a pile of stock which crowded against it. The fire passed from the section of its origin to the other section through the opening which remained unprotected.

The illustrations show clearly the ability of standard fire doors to withstand a severe fire. This fire also demonstrates the vital importance of keeping storage away from fire doors and passageways clear at all times. All fire doors should be closed at night regardless of the fact that they are automatic.

H-7613

H-7613

Details of fire door third story. Shows how standard door and hardware stood effect of heat. Hole was cut to show core. Door did not close, due to stock piled in doorway. Note blisters on tin and hardware from heat.

Fire Causes.

The fires here given are selected to illustrate defects, either of construction or superintendence, in the classes of property indicated.

H-7291. Mercantile. Fire attributed to presence of small gas floor heater attached to under side of joist constructed floor.

H-7451. Tenant Building. A gas floor heater was left burning at night after closing. The gas pressure increased after midnight, causing the "heater" to become overheated, and setting fire to floor.

Heaters of this type are always hazardous, and their use should be discouraged.

S-12502. Hair Dresser. Gas heater ignited hair dye.

H-7585. Metal Worker. Employee was looking for a leak in a gas pipe with a match. He found it—as usual. An explosion and fire followed.

H-7597. Metal Worker. Employee hung oily overalls over steam pipes to dry. They ignited and set fire to building.

S-12544. Cotton Mill. Wooden sheathing boxing around steam pipe came in contact with pipe in numerous places and charred it. Fire originated from this cause.

Steam pipes should never be enclosed with boxing, nor come in contact with woodwork.

S-12175. Piano Factory. Spontaneous ignition of oily rags and sawdust in a wooden barrel.

Wooden barrels should never be used for refuse containers.

S-12612. Drug House. Fire caused by spontaneous ignition of an oily mop.

S-12496. Furniture Factory. Sparks from boiler ignited woodworking refuse in front of boiler after plant had been shut down. Shavings fed direct to boiler while plant is running, but as soon as plant is shut down spout to boiler is removed and a few shavings drop on floor.

Standard shaving vaults should always be provided and shavings blown to these when not fed direct to boiler.

S-12508. Tenant Building. Match, cigarette or cigar stub in box of sawdust used for spittoon.

The use of sawdust for this purpose is always a hazard.

H-7568. Department Store. Man threw a cigarette stub into waste paper basket under his desk.

H-6904. Patent Medicine Factory. Match or cigarette thrown out of window above and set fire to awning.

Awning fires due to the carelessness of smokers are very frequent. Awning should be treated with fireproofing solutions.

S-12485. Office Building. Man employed to varnish partitions of an office lighted a cigarette and threw a match into pail of filler.

S-125. Tenant Mercantile. Fire caused by lighted cigar or cigarette butt carelessly thrown into basket.

S-12581. Tenant Manufacturing. Cigar, cigarette or match thrown in corner back of bale of clean rags.

The careless disposal of cigar, cigarette or match is a constant source of fire.

S-12595. Paint Factory. Electric light socket, with rubber button broken off, came in contact with a tin plate nailed on floor at paint machine. Light was being used by workman at time of fire.

H-7535. Mercantile. Fire caused by ignition of rubbish in basement near furnace.

H-7641. Wholesale Grocery. Mechanics were employed in repairing elevator machinery, and were using lighted candle. One of these was allowed to fall behind a casing of the elevator shaft. It landed on some greasy wood, set it on fire, and the whole shaft was ablaze before aid could be summoned.

S-12643. Furniture Store. Employee looking for chair with a lighted candle set fire to excelsior wrapping around chairs.

S-12632. Garage. Employee was emptying the non-volatile residue out of the carbureter on a machine, and was washing it out with gasolene. A quantity of gasolene dropped on the floor and evaporated. An employee opened the glass front of an oil lamp on machine to blow it out, when the gas took fire.

The process of emptying the non-volatile residue in the carbureter, on account of the explosive vapors in the carbureter and pipes, should never be performed near an open light.

S-12663. Garage. Ordinary oil lantern used while gasolene was being poured into tank on automobile from open pail. Gasolene splashed on lantern and ignited oil.

H-7600. Garage. Vapors from gasolene ignited from fire in coal stove in rear part of garage.

This occurrence demonstrates that most subtle and insidious characteristic, which is more marked in the benzines than in any other class of volatile.

S-12519. Shoe Shop. Mixture of naphtha, ammonia and chalk used to clean white leather shoes setting on bench with a gas tree iron stove became ignited.

This fire illustrates the danger of having open gas flames near any compound containing naphtha.

S-12102. Printery and Bindery. Fire caused by wooden block in friction gear against wheel on waterwheel shaft, and sparks from this dropped to pine cases of paper on the floor, igniting same.

Points of Interest from Fire Reports.

These notes are intended to illustrate the efficiency or inefficiency of signaling, retardant or extinguishing agencies.

Alarm Service.

S-12510. Jewelry Factory. Engineer slept at factory in engine room Operation of sprinkler alarm valve notified him, and he transmitted alarm to fire department by telephone.

S-12575. Tenant Manufacturing. This was a large plant. Small fire occurred on a lower floor while watchman was in another portion. He did not hear the operation of alarm valve, and 3,000 gallons of water were discharged before discovery.

S-12648. Furniture Factory. Fire occurred in engine room while night watchman was making a round. On returning he found three sprinklers in operation, but the fire was extinguished. He did not know how to shut off the water, so called up the day engineer. When he reached factory the boiler room was flooded.

All watchmen in sprinklered plants should thoroughly understand the sprinkler system.

Automatic Sprinklers.

S-12574. Carriage Factory. Fire caused by ignition of wood which was piled on top of boiler to dry. The sprinklers failed to hold fire, owing to the obstruction to distribution from the wood which was piled too high.

S-12180. Cotton Waste Mill. Fire occurred in dryer where a 286° "Jumbo" head was located. This failed to operate.

S-12630. Department Store. A fire which originated in an unsprinklered ventilating space over lavatories in basement, demonstrated the following:—

That complete sprinkler protection calls for the installation of sprinklers throughout the building, including concealed spaces. They should be installed even where the possibility of fire seems the most remote. In any event, sprinklers should be installed in or under ventilating ducts or flues.

Construction.

S-12630. Department Store. This fire demonstrated the undesirability of metal ceilings from the fact that sprinkler protection in the joist channels

is entirely cut off and also the ceilings offer quite serious obstruction to the work of the firemen.

S-12522. Paper Mill. Three fires occurred in a temporary wooden gas scrubber on top of economizer house.

Structures of this kind on top of plank roofs are hazardous and should be replaced by non-combustible construction.

Floor Openings.

S-12630. Department Store. Fire spread through heat and ventilating flues.

All ventilating flues or heat ducts where passing through one or more floors should be substantially constructed of heavy metal or other non-combustible substance.

H-7515. Metal Worker. Belt holes were an important factor in the spread of fire which caused a loss of over $20,000.

Many belt holes are much larger than need be, and add to the destruction which is indirectly attributable to "floor openings."

Inside Protection.

H-7510. Harness Factory. Linseed and lubricating oils in the vicinity of fire. Employees used a fire hose and endeavored to extinguish the fire, but the water spread flames until floor was in a short time covered with burning oil on top of the water. Plant was a total loss.

A few sand pails in the vicinity of the oil would have been sufficient for the complete extinguishment of the fire if they had been used when fire was first discovered.

Outside Protection.

S-12562. Celluloid Works. Sprinklers failed to hold the fire and outside equipment was resorted to, but no streams could be obtained from either a private or public hydrant. They were found to be frozen.

Hydrants should be carefully drained before cold weather and regularly inspected thereafter.

Storage.

S-12507. Paper Box Factory. Fire occurred in basement in baled paper storage, and one sprinkler operated. Fire was quickly extinguished.

Considerable water damage was averted, owing to fact that all the stock in basement was placed on skids.

Standard Rules and Requirements

PUBLISHED BY THE

National Board of Fire Underwriters

UPON RECOMMENDATION OF

THE NATIONAL FIRE PROTECTION ASSOCIATION

A copy of each revised edition of these pamphlets is mailed to members of the National Fire Protection Association on publication. Members desiring additional copies may obtain the same, without charge, by addressing the Secretary.

SUBJECTS.	Last edition.
Acetylene Gas Machines and Storage of Calcium Carbide	1910
Coal Gas Producers (pressure and suction systems)	1908
Electric Wiring and Apparatus (Nat'l Electrical Code)	1911
Electrical Fittings, List of Approved	April, 1912
Fire Departments, Private	1902
Fire Doors and Shutters	1908
Fire Extinguishers, Chemical (for other than fire department use)	1909
Fire Hose, for fire department use	1912
Fire Hose, for private department mill yard use	1912
Fire Hose, Unlined Linen, for use inside buildings	1909
Fire Pumps (steam)	1911
Fire Pumps (electric)	1904
Fire Pumps (centrifugal)	1911
Fire Pumps (rotary)	1911
Gas and Gasolene Engines	1910
Gasolene Vapor Gas Lighting Machines, Lamps and Systems	1910
Gasolene Vapor Stoves, for cooking and heating	1903
Grain Dryers	1901
Gravity Tanks	1910
Hose Couplings and Hydrant Fittings, for public fire service	1911
Hose Houses, for mill yards	1905
Incubators and Brooders	1908
Kerosene Oil Pressure Systems	1902
Lightning, Protection Against	1907
Municipal Fire Alarm Systems	1911
Nitro-Cellulose Films (storage and handling)	1910
Oil Storage (fuel), storage and use of fuel oil and construction and installation of oil burning equipment	1902
Oil Storage (inflammable), systems for storing 250 gallons or less of fluids which at ordinary temperatures give off inflammable vapors	1904
Oxy-Acetylene Heating and Welding Apparatus	1910
Railway Car Houses (storage and operating), Construction and Protection of	1907
Signaling Systems, used for the transmission of signals affecting the fire hazard	1911
Skylights	1906
Sprinkler Equipments automatic and open systems	1910
Steam Pump Governors and Auxiliary Pumps	1908
Uniform Requirements (standard mill construction, "inferior" construction, general hazards, oil rooms, general protection, stairway and elevator closures, watchmen, thermostats, etc.)	1911
Valves, Indicator Posts and Hydrants, for mill yard use	1910
Waste Cans, Ash Cans, Refuse Barrels, Fire Pails and Safety Cans for Benzine and Gasolene	1903
Wired Glass and Metal Window Frame Construction	1906
Underwriters' Laboratories, general information in reference to the nature of its work and the terms and conditions under which tests of fire appliances and materials are conducted	1911

NOTE: **Special lists** of Fire Appliances, Devices and Materials, and Gas, Oil and Chemical Appliances, examined and tested by Underwriters' Laboratories, Inc., under the above standards and deemed suitable for use, are mailed to members semi-annually in January and July.

Apply to FRANKLIN H. WENTWORTH, *Secretary*,

87 MILK STREET, BOSTON, MASS.